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THE INFLUENCE OF MENTAL WORK ON THE VISUAL MEMORY IMAGE.

By Anna Berliner.

First Series:

The problem is the comparison of the mental image in the morning and at night. The experiments were made before the observer started his mental work or a short time after starting, and were repeated after a day's mental work. One morning experiment and one night experiment were always made on the same day. In the morning as well as at night the experiments were carried on in the following way. A certain drawing[1] was exposed five seconds. Then the observer closed his eyes and waited thirty seconds in order to avoid after-images of the drawing and of stimuli which might excite him by chance. The observer was told not to think of the picture during the thirty seconds. The experimenter generally tried to distract him by inquiring about the work the observer had done before the experiment. At the end of the thirty seconds the signal "Try to call it up now," was given. The signal was given so that "now" followed one second after "try." The observer then tried to call up the memory image. As soon as he succeeded in seeing it, he pressed a key. The instant the image disappeared he released the key. The pressing and releasing of the key was recorded by a pointer on a kimograph. Time was measured by a metronome. The instruction given to the observer was: "Press the key as

[1] The drawings are described on p. 357.

soon as you *see* anything of the image at all, and only if you *see* it." The first time the instruction was given the experimenter asked if the observer was able to distinguish between *thinking* of the image and *seeing* it. The observer generally found no difficulty in making this distinction. Each time an observer was doubtful as to whether he really saw the image or only thought of it, a note was taken. The observation[2] took thirty seconds, at the end of which time a short introspection was required. There was no special instruction given for the introspection. The experimenter was afraid that any question might be suggestive, and therefore asked only for introspection as such. At each sitting the observation was repeated three times. There was a difference, however, between the first observation and the second and third, in that the drawing was not exposed again to the observer. The time between the second and first as well as between the second and third observation was determined by the duration of the introspection.

It is evident that the first observation takes place under conditions different from those of the second and third observation. It is improbable however that the first observation has to do with the so called primary memory image or memory after-image, as it is usually assumed that the primary memory image does not last longer than 20 or 30 seconds.[3] The motive for making the first observation different from the two succeeding observations was to observe the influence of mental work on the memory image under different conditions. We chose the long exposure of five seconds in order to be sure of a thorough acquaintance with the picture. The experiments are not memory experiments but experiments about the mental image. The special kind of mental image, memory image, was decided upon, because it allows greater control of experimental conditions than the imagination image.

Eight observers (*A, B, C, D, E, F, G, H*) took part in the series. One of the observers was an instructor, five were graduate students, and two were undergraduates of Columbia University. *A, B, C, D* served throughout the whole experi-

[2] When we speak in the following about an observation we always mean observation as described here. Thus the time the observer keeps the images during an observation is different from the time a single image lasts unless the observation contains only one image.

[3] J. W. Slaughter, "A Preliminary Study of the Behaviour of Mental Images." *Am. Jour. Psychol.*, 1902, 13, p. 530, and Alma de Vries Schaub, "On the Intensity of Images," *Am. Jour. Psychol.*, 1911, 22, p. 354.

ment (five times), including both morning and evening sittings. As each experiment comprises three observations, each of these subjects observed fifteen times in the morning and fifteen times at night. Observers *E, F, G, H* performed only three morning and three night experiments each, thus observing nine times in the morning and nine times at night. Altogether 192 observations were recorded.

In the experiments with *A, B, C, D, G,* and *H* the picture used as stimulus was a simple geometrical figure, red with black outlines. It was the figure which is obtained by drawing three half circles around three equidistant points of a circle, using the radius of the original circle for the three half circles. The radius was *2 cm.* The coloring was done by crayons. It seemed desirable to find how far the results obtained with this picture were independent of the special drawing. Three pictures were therefore devised which differed from the first in the following respects. Whereas the first picture was a purely geometrical figure, the three other pictures were drawings of objects. Whereas the first picture was red, the three other pictures showed as main coloring green or blue or yellow. The second picture, representing a leaf, had, like the first only one color besides the black outline. The third picture, a duckling, had a yellow body, red feet and beak, and a faint green base. The last picture was a blue flower with a yellow centre. The first picture was used for all observers with the exception of *E* and *F*. Observers *E* and *F* were shown picture *2* on the first day, picture *3* on the second day, and picture *4* on the third day. It must be admitted that the conditions for the morning and night experiments were not the same in the experiments with the last two observers. The picture when exposed in the morning was an unknown one, whereas it was familiar to the observer at the beginning of the night experiment. In the experiments with picture *1*, the same picture was used over and over again; and from the second day on, it was already familiar in the morning experiment. As no difference was found between the experiments where only one picture was used, and the experiments where a different one was used every day, we are justified in neglecting this irregularity in the experiments with changing pictures.

The time which intervened between the morning and night experiments was for observer *A, 9* hours; for observer *B, 12* hours; for observer *C, 6* hours; for observer *D, 8* hours; for observer *E, 8* hours; for observer *F, 10* hours; for observer *G, 8* hours; and for observer *H, 7* hours.

Quantitative Results:

The results are given in tables *1*, *2*, and *3*. Table *1* gives the averages for all three observations; table *2* shows the results of the observations with exposition, the first observations; and the third table contains the figures for the two observations without exposition. The first column gives the number of observers, the second the number of observations. Then follows the average time the image is kept in one observation. The next column shows the average duration of a single image found by dividing the whole time the image is kept during all experiments by the number of images of all experiments together. Column five contains the average number of images for one observation, and column six gives the average time necessary to arouse the first image. The figure for the night experiment is always placed beneath that of the morning experiment; time is given in seconds; the figures in parenthesis give the average deviation. With but one exception (*G* in table *2*) the figures for the time an observer can keep a mental image during thirty seconds are longer in the morning than in the night experiments. With three exceptions (*C* in table *3*; *G* and *D* in table *2*) the duration of the single image is longer in the morning than in the night experiments. These exceptions appear only in tables *2* and *3*. They disappear as soon as we take all experiments together as in table *1*. This fact justifies the assumption that the exceptions are due only to the small number of observations, and thus justifies the conclusions:

1. The time an observer can keep a mental image during a certain period is longer in the morning than at night.

2. The duration of a single image is longer in the morning than at night.

The figures for the number of images are not so evenly distributed. We find in each table cases where the number of images is smaller in the morning as well as cases where it is larger. There is, however, a general tendency for the images to be more numerous in the morning experiments. We thus conclude:

3. The number of images aroused during a certain period tends only very slightly to be larger in the morning than at night.

The same condition obtains with the time required to call up the first mental image. The figures allow the conclusion:

4. The time required to call up the first mental image tends only very slightly to be larger at night than in the morning.

The fact that the results for the arousal are much less regular than those for the duration is in harmony with a remark of Burtt: "It may be noted in passing that the whole series of experiments on imagery indicates that the time of holding is a much better criterion by which to judge the influence of various factors upon imagery, than is the time of arousal."[4]

Another way to compare the different factors with regard to their sensitiveness as indicators of mental work is to consider the ratios of the figures from the morning and night experiments of all observers together. Table *4* gives the figures for the first, second and third observations, and their sum for all observers. As the time for the arousal is longer at night than in the morning, we have to take the reciprocal values (as indicated in parenthesis) in order to make a comparison possible. We find little difference between the ratio for the time the image is kept and the duration of the single image. We notice, however that the ratio is somewhat steadier for the time the image is kept since the deviation for the first, second, and third observation is *—8, 0, +7*, whereas it is *—7, —6, +16*, for the duration of the single image. Contrary to our expectations from the first three tables, the time for the arousal of the first image is a better indicator than the time the image is kept and the duration of the single image. The ratio of the sums is as high as *1.72*. The explanation lies in the fact that the time for the arousal does not differ regularly in the morning and night experiments, but once being different at all, generally shows a great difference.

Another way of comparing the sensitiveness of the different factors in regard to the influence of mental work is the percentage of experiments that show the one or the other of the factors influenced by the mental work. The time the image is kept is longer in the morning than at night in *87.5%* of the experiments, shorter at morning than at night in *12.5%*. The same relation obtains with the duration of the single image; *87.5%* of the experiments give smaller figures in the morning and *12.5%* give smaller figures at night. The number of images is found to be smaller at night in *50.0%*, larger at night in *41.0%* and equal in *9.0%*. The time necessary for the arousal of the first image is in *69.0%* shorter, in *28.0%* longer and equal in *3.0%*. These figures support the result gained before i. e. that the time the image is kept and the duration of the single image are equally sensi-

[4] Harold E. Burtt, "Factors which Influence the Arousal of the Primary Visual Memory Image." *Am. Jour. Psychol.*, 1916, 27, p. 96.

tive factors with regard to the influence of mental work. The number of images is hardly influenced at all. The time the image is kept in one observation, the duration of the single image, and the number of images are not independent factors, but limited by the relation

$$\frac{\textit{time the image is kept}}{\textit{number of images}} = \textit{duration of the single image}.$$

Thus as long as the number of images is not influenced by the mental work the time the image is kept and the duration of the single image must be equally sensitive factors. On the other hand, in so far as the duration of the single image is less sensitive than the time the image is kept in one observation, the number of images shows the influence of the work. The last factor, the arousal of the first image, shows quite a considerable surplus of cases with quicker arousal in the morning. It is, however, not as good an indicator as the duration of the images. This fact supports the explanation given above for the discrepancy between the figures of the first three tables and those of the fourth table. The arousal is not always influenced, but, once having been affected, shows this influence stronger than any of the other factors.

Giving the figures for the first, second, and third observations separately, Table *4* allows a comparison of those three different observations. As already mentioned, only the first observation of each experiment was preceded by an exposure of the objective picture. The observation followed thirty seconds after the exposure. The other observations followed as soon as the introspection was finished. We find that the ratios for the first, second, and third observations increase from the first to the second, and from the second to the third in the columns for the time the image is kept, as well as in the columns for the duration of the single image. Those columns that give the number of images do not allow any comparison because they vary in an irregular way and only slightly from *1*. Apparently the data for the arousal of the first image follow the same regularity as those of the columns for the time the image is kept and the duration of the single image. But this regularity is only apparent. The smaller the ratio, the greater is the difference between the morning and the night experiment. Thus while for the time the images are kept and the duration of the single image the first observation is less sensitive than the second, and the second less than the third, we find the opposite results with the time for the arousal of the first image. Here the third observation is a better indicator than the second, and the second better than the first.

In order to see if the ratio is influenced by practice we separate observer *A*, *B*, *C*, and *D* who went through five experiments from *E*, *F*, *G*, and *H* who performed only three experiments. Table 5 gives the ratio for the time the image is kept in the first two rows. The first row contains the quotient of the sums of *A*, *B*, *C*, and *D's* figures. The second row shows the ratio of the sums of *E*, *F*, *G*, and *H's* figures. In the same way the third and fourth row give the duration of the single image, and the fifth and sixth row the ratios for the time necessary to arouse the first image. We find neither a decrease nor an increase.

It may be noticed in passing that this arrangement too yields only ratios that are greater than 1. This means that if we combine the figures for all observers for a single day we always obtain for the time the image is kept and for the single image a greater duration in the morning than at night, and for the time necessary to call up the first image, a longer duration at night than in the morning. It will be understood that Table 5 gives the reciprocal values for the arousal of the image; this means that the ratio is found by dividing the evening value by the morning value.

The number of observers is too small to justify general conclusions regarding the influence of the number of working hours between the morning and the evening observations, on the difference of the results. It is nevertheless quite interesting to compare the data in relation to this factor. If x is the average of the duration of the images in the morning, and y that of the images at night, then $\frac{x+y}{x-y}$ will be smaller the greater the difference of x and y. This quotient will be a definite value for each observer. A second value for each observer is found in the number of hours that passed between the morning and evening observation.[5] If we correlate these two series of values according to the product-moment's method of Pearson (omitting observer *G*, in regard to which see table 2) we obtain $r = -0.50$, with a probable error ± 0.19.[6] The coefficient suggests that the greater the time interval the greater the difference between morning and evening

[5] It is evident that the number of hours passed between the two experiments is no correct measure for the work done. Most of the hours were spent studying, going to lectures or lecturing. But occasionally the observer reported a walk or some other rest between.

[6] If we take $\sigma = \sqrt{\frac{\Sigma (d)^2}{r-1}}$ instead of $\sqrt{\frac{\Sigma (d)^2}{r}}$, $r = -0.41$.

observation. Including observer *G* we obtain the coefficient $r = -0.18$,[7] with a probable error of ± 0.23.

It might be objected that the difference between the morning and night experiments is not caused by differences in the subjects but by difference in the light. A great part of the experiments at night was carried on by artificial light, whereas natural light was generally used in the morning. Observer *H*, however, did all experiments by natural light; and her data do not differ from those of the other subjects. This fact suggests that the differences are not due to different light. Even if we assume that it was somewhat darker in the afternoon experiments than at morning the probability of getting better images at night would be greater than the opposite. Wundt states that "unsere Erinnerungsbilder sind im Dunkeln oder Halbdunkel ungleich lebendiger als im Licht des Tages."[8]

Qualitative Results:

If we compare the images in regard to color, shape, outline, clearness, vividness, and ease of evocation, we find only three observers whose images before the mental work and after the mental work differ markedly in most of these respects. They are observers *B*, *E*, and *H*. Even with these observers, not every image in the morning observation was good nor every image in the evening observation poor. But in general the images were better in the morning. With observer *B*, the most conspicuous fact is that he found it very hard to call up an image at night. "I could not get it at all, it was very hard to call it up." "I could not get a thing, perfectly blank." "It was just a sort of brown all over, not sharp outlines as this morning," were his reports. No remark of that kind occurred in the morning observations. The images at night were not only hard to call up, but they were vague, blurry, and poor in colors. "No color or anything, just vague blur." Observer *E* too had great difficulty in getting any color at night. "It did not have the color characteristics, and I could not get them although I kept thinking of black and green." "I could not seem to get any color there. It was just a shadowy bird, a grayish bird." We find quite a different introspection in the morning observations. "The yellow centre seemed to stand out most sharply; it was a

[7] For $\sigma = \sqrt{\frac{\Sigma (d)^2}{r-1}}$, $r = -0.16$.

[8] W. Wundt, Elemente der Völkerpsychologie, 1912, p. 25.

more saturated yellow than in the original," is typical of the replies. The difference in the other qualities is not quite so conspicuous as that of the coloring but nevertheless stands out quite clearly. I quote a few more descriptions given by *E* in the night experiments. "That was so exceedingly faint and indefinite when I got it that I am almost inclined to doubt if it was an image at all." "It was a fluctuating shadow; it did not have any sharply defined circumference." A few morning introspections follow: "I had no difficulty at all in getting a splendid image. I never lost it completely. It just seemed to become a little fainter, and then become very clear again." "I immediately got a very satisfactory image, and it remained." "It seemed to be a perfect representative of the objective design." Observer *H* shows the same marked difference in colors as observer *E*. She mentioned color only once at night and on that occasion she reported only: "Not much color." There is on the other hand, not a single morning observation without color. Reports ran, "The colors were very bright," or "The colors were very clear and vivid." She too found it hard to call up the image at night. In only one night observation do we find that it was not hard to call up the image, whereas we find several morning introspections like the following: "I found it awfully easy to call the image up." "Easy to get the image." Her images were in general distinct and clear in the morning and indistinct and fluctuating at night. "It was not nearly as clear as in the morning." Observer *A's* images were poor in the morning as well as at night. The only difference seems to be that she very often describes her images at night as fleeting. There is only a very slight difference with *F*, and it is doubtful if there is any difference at all with *C*, *D*, and *G*.[9]

Before concluding series *1*, two observations may be pointed out which although not connected with our problem, are of interest for the psychology of the visual memory image. The time the image is kept is longer in the first than in the second observation, and longer in the second than in the third observation. This obtains for the morning as well as the night experiment. The same regularity is repeated in the night experiments for the duration of the single image.

[9] On the whole our experiments do not agree with Murray's results: "It soon became evident....that distinction and vividness were more constant and more significant factors than mere duration and recurrence." E. Murray, "Peripheral and Central Factors in Memory Images of Visual Form and Color." *Am. Jour. Psychol.*, 17, 1906, pp. 227 f.

The morning experiments, however, yield only the result that the first observation is superior to the average of the two following observations. Again the number of images does not show any regularity. The time for the arousal increases from the first to the second and from the second to the third observation, thus proving like the duration, that the first observation is superior to the second and the second to the third.

The second remark concerns the effect of practice. Table 6 separates those observers that observed only three times from those that observed five times. The table gives the time the images are kept and the time necessary for the arousal of the first image. The figures for the subjects that observed only three times seem to suggest some practice effect but this suggestion is not supported by the subjects that observed five times. This result is in harmony with Foster's remark: "In no case did practice increase the ability or even the tendency to visualize."[10] Since the subjects that observed five times are more reliable than the other observers, it is even possible to see in Table 6 an indication that the mental image deterioriates with practice. This would support the often stated laboratory experience that the more an observer occupies himself with mental imagery the harder he finds it to call up a satisfactory image.

Second Series:

The problem here is the comparison of the visual memory image before and after a short time of intensive mental work. The intensive work consists in adding after Starch's method.[11] The adding was done for half an hour. The observer was told to do the adding as correctly and as quickly as possible. One undergraduate student of California and one graduate student of Columbia University took part in the experiment. The experiments in general were carried on in the same way as those described in the first series. The main difference lies in the fact that we compare the observations before and after the adding instead of those in the morning and at night. One of the observers (*I*) performed

[10] W. S. Foster, "The Effect of Practice upon Visualizing and upon the Reproduction of Visual Impressions." *Jour. Ed. Psychol.*, 1911, 2 p. 11.

[11] "The experimenter announced to the observer a number consisting of two digits. The observer then added 6 to this number, then 7 to the new sum, then 8 to that, and then 9, and then again 6, 7 8, and 9 in rotation...." D. Starch, *Experiments in Educational Psychology*, pp. 36 f.

one observation before and one after the adding. The other observer (K) observed twice before and twice after the adding. The results are given in Table 7. They show:

1. *The time the images are kept during one observation is longer before than after the work.*
2. *The average duration of the single image is longer before than after the work.*
3. *The number of images tends only very slightly to be larger before than after the work.*
4. *The time for the arousal of the first image is in one case much shorter before than after the work; in the other case it is not influenced at all by the work.*

So far as two observers allow a generalisation, the results show that mental work tends to vitiate the visual memory

TABLE I

1	2	3	4	5	6
Observer	Number of observations	Average time the image is kept in one observation	Average duration of the single image	Average number of images	Average time for the arousal of the first image
A	15	8.2 (1.6)	1.2	6.6 (0.8)	1.8 (0.8)
	15	5.2 (1.1)	0.9	6.1 (0.9)	1.9 (0.8)
B	15	18.6 (2.4)	8.7	2.1 (0.6)	5.2 (1.1)
	15	4.5 (2.7)	2.8	1.6 (1.0)	16.8 (7.3)
C	15	9.5 (4.3)	1.7	5.7 (2.3)	6.9 (6.4)
	15	7.6 (3.2)	1.6	4.7 (1.4)	5.0 (4.0)
D	15	24.3 (1.8)	5.7	4.3 (0.8)	0.7 (0.4)
	15	22.0 (3.9)	5.1	4.3 (1.2)	0.6 (0.3)
E	9	17.1 (4.9)	4.9	3.5 (1.1)	4.9 (2.6)
	9	8.9 (3.4)	2.7	3.3 (1.0)	10.8 (4.8)
F	9	25.2 (1.1)	6.3	4.0 (0.6)	1.9 (0.5)
	9	21.1 (2.0)	4.0	5.2 (1.4)	2.8 (0.5)
G	9	6.8 (3.2)	1.1	6.1 (0.8)	0.8 (0.3)
	9	6.7 (3.7)	1.0	6.9 (1.0)	0.8 (0.4)
H	9	9.9 (3.5)	2.3	4.3 (0.5)	3.0 (0.9)
	9	6.2 (1.1)	1.2	5.1 (0.6)	5.7 (0.9)

image; this result agrees therefore with our first series of experiments. In regard to the sensitiveness of the different factors, too, this series supports the results of the first series. The time the image is kept and the duration of the single image are the best indicators for the influence of the mental work on the image. The number of images hardly shows any influence at all, and the time necessary for the arousal is very unreliable. Here again those factors that are fine indicators, the duration of the single image and the time the image is kept, are more sensitive in the second than in the first observation.

As in the case of our first series, so here too we find a few observations that do not pertain to the problem in question, but are of interest for the psychology of the memory image. Comparing the first and the second observation of

TABLE 2

1	2	3	4	5	6
Observer	Number of observations	Average time the image is kept in one observation	Average duration of the single image	Average number of images	Average time for the arousal of the first image
A	5	9.0 (1.4)	1.3	6.8 (1.0)	1.8 (0.8)
	5	5.4 (1.1)	0.9	5.8 (0.6)	1.2 (0.4)
B	5	17.9 (2.3)	8.1	2.2 (0.6)	5.2 (1.2)
	5	6.4 (3.9)	3.6	1.8 (1.0)	16.6 (8.0)
C	5	9.3 (4.3)	1.7	5.6 (1.9)	4.3 (2.4)
	5	6.4 (3.9)	1.5	4.4 (1.3)	6.0 (4.6)
D	5	24.1 (1.9)	6.0	4.0 (0.8)	0.9 (0.4)
	5	22.5 (4.4)	6.3	3.6 (0.7)	0.7 (0.5)
E	3	18.2 (1.8)	5.5	3.3 (0.4)	3.3 (1.1)
	3	11.7 (3.8)	3.2	3.7 (1.1)	6.5 (1.7)
F	3	26.7 (0.6)	6.7	4.0 (0.7)	1.5 (0.3)
	3	22.2 (2.2)	4.1	5.3 (1.8)	2.2 (0.2)
G	3	4.5 (1.3)	0.8	6.0 (0.0)	1.0 (0.3)
	3	7.0 (3.3)	0.9	7.7 (1.1)	1.3 (0.5)
H	3	11.3 (3.3)	2.6	4.7 (0.6)	2.2 (0.2)
	3	6.0 (0.8)	1.1	5.3 (1.3)	6.7 (0.5)

observer *K* we find that the image is poorer in the second observation than in the first. This difference obtains throughout, and for the experiment before the adding as well as for that after the adding. Comparing the different days we see that there is neither a decrease nor an increase of the time the image is kept in one observation (Table 8).

TABLE 3

1	2	3	4	5	6
Observer	Number of observations	Average time the image is kept in one observation	Average duration of the single image	Average number of images	Average time for the arousal of the first image
A	10	7.8 (1.6)	1.2	6.6 (0.7)	1.8 (0.6)
	10	5.2 (1.1)	0.8	6.4 (1.2)	2.1 (0.9)
B	10	18.9 (2.4)	9.0	2.1 (0.5)	5.3 (1.2)
	10	3.6 (2.1)	2.4	1.5 (1.0)	17.0 (6.7)
C	10	9.6 (4.5)	1.7	5.7 (2.5)	8.3 (8.5)
	10	8.2 (3.3)	1.7	4.8 (1.4)	4.5 (3.8)
D	10	24.4 (1.7)	5.6	4.4 (0.8)	0.6 (0.3)
	10	21.6 (3.5)	4.6	4.7 (1.3)	0.6 (0.3)
E	6	16.7 (6.3)	4.8	3.5 (1.3)	5.8 (3.1)
	6	7.6 (2.4)	2.4	3.2 (0.8)	13.0 (5.8)
F	6	24.5 (0.8)	6.1	4.0 (0.8)	2.1 (0.6)
	6	20.6 (1.6)	4.0	5.1 (1.2)	3.1 (0.3)
G	6	8.0 (4.0)	1.1	6.2 (1.2)	0.6 (0.5)
	6	6.5 (3.8)	1.0	6.5 (0.8)	0.6 (0.3)
H	6	9.1 (3.1)	2.2	4.3 (0.5)	3.3 (0.8)
	6	6.3 (1.3)	1.2	5.0 (0.4)	5.2 (0.7)

TABLE 4

Observation.		1	2	3	Σ
Time the image is kept;	morning	483.50	479.50	475.24	1438.25
	night	344.25	323.00	307.00	974.25
	ratio	1.40	1.48	1.55	1.48
Duration of the single image;	morning	3.31	3.15	3.30	9.76
	night	2.39	2.27	2.05	6.71
	ratio	1.38	1.39	1.61	1.45
Number of images;	morning	146	152	144	442
	night	144	142	150	436
	ratio	1.01	1.07	0.96	1.01
Time for the arousal of the first image;					
	morning	84.50	100.00	130.50	315.00
	night	171.75	180.00	189.75	541.50
	ratio	0.49	0.56	0.69	0.58
		(2.08)	(1.78)	(1.45)	(1.72)

TABLE 5

Day:		1	2	3	4	5
Time the image is kept	(A, B, C, D)	1.60	1.48	1.41	1.44	1.85
	(E, F, G, H)	1.44	1.22	1.43	....	....
Duration of the single image	(A, B, C, D)	1.27	1.05	1.55	1.42	1.58
	(E, F, G, H)	1.85	1.25	1.64	....	....
Time necessary for the arousal	(A, B, C, D)	1.40	2.01	1.06	1.31	2.45
	(E, F, G, H)	2.02	1.68	2.02	....	....

TABLE 6

Day		1	2	3	4	5
Time the images are kept	Morning	187.50	183.75	171.75	177.75	187.00
	Night	117.25	124.25	121.75	123.25	101.75
	Σ	304.75	308.00	293.50	301.00	288.75
Arousal	Morning	30.00	34.75	54.50	51.00	49.50
	Night	42.00	70.00	57.50	66.75	122.25
	Σ	72.00	104.75	112.00	117.75	171.75
Time the images are kept	Morning	167.75	137.75	224.25	.....	.....
	Night	116.75	112.75	156.50	.....	.....
	Σ	284.50	250.50	380.75	.....	.....
Arousal	Morning	40.25	33.75	21.25	.....	.....
	Night	81.25	56.75	43.00	.....	.....
	Σ	121.50	90.50	64.25	.....	.....

Time is given in seconds. The figures represent the sums of *A*, *B*, *C*, and *D* in the upper half, and the sums for *E*, *F*, *G*, and *H* in the lower half.

TABLE 7

Observer	Number of observations	Average time the image is kept	Average duration of the single image	Average number of images	Average time necessary for the arousal of the first image
I. before the work:	6	14.4 (3.6)	12.4	1.1	7.5
after the work:	6	7.2 (2.9)	7.2	1.0	12.8
ratio:		1.96	1.72	1.1	1.71*
K before the work:					
first observation	5	6.4 (1.2)	1.0	6.6	1.9
second observation	5	4.6 (0.9)	1.0	5.6	3.4
Σ : 2		5.5	1.0	6.1	2.65
after the work:					
first observation	5	5.6 (1.0)	0.9	6.0	2.6
second observation	5	3.9 (0.4)	0.7	5.4	2.7
Σ :2		4.75	0.8	5.7	2.65
ratio: first observation		1.14	1.11	1.1	0.73*
second observation		1.18	1.43	1.04	1.26*
Σ		1.16	1.25	1.07	1.00

Time is given in seconds. The figures in parenthesis give the average deviations. The figures with the * are gained by dividing the figures after the work by the figures before the work.

TABLE 8

TIME THE IMAGES ARE KEPT

Observer: Day:	1	2	3	4	5	6
I. before the work:	15.00	22.50	7.50	11.00	16.50	13.50
after the work:	6.00	14.50	7.00	6.00	1.00	8.50
K. before the work:	4.75	14.25	4.50	6.75	4.75	.....
after the work:	5.25	4.75	6.00	4.00	4.00	.....
Σ before the work:	19.75	36.75	12.00	17.75	21.25	.....
Σ after the work	11.25	19.25	13.00	10.00	5.00	.....
ΣΣ:	31.00	56.00	25.00	27.75	26.25	.....

TABLE 8—Continued

AROUSAL OF THE FIRST IMAGE

Observer: Day:	1	2	3	4	5	6
I. before the work:	9.50	2.50	7.00	12.00	5.50	11.50
after the work:	9.50	10.50	18.00	10.50	12.00	16.50
K. before the work:	1.25	2.00	3.00	4.00	2.25	.....
after the work:	1.25	3.00	2.25	4.25	2.25	.....
Σ before the work:	10.75	4.50	10.00	16.00	7.75	.....
Σ after the work:	10.75	13.50	20.25	14.75	14.25	.....
ΣΣ:	21.50	18.00	30.25	30.75	22.00	.....

THE THEORY OF RECAPITULATION AND THE RELIGIOUS AND MORAL DISCIPLINE OF CHILDREN

By Wesley Raymond Wells, Washington University

There is no such thing as a modern infant. The modern individual begins his career at precisely the same point at which each cave-man started. Only in the world of mythology does an individual spring forth, like Minerva, full-fledged in wisdom. In the actual world a long period of infancy, childhood, and youth must precede intellectual and moral, as well as physical, maturity. Present-day studies in genetic psychology have begun to reveal the real needs of the child, needs that are not at all the needs of the adult. Just as the infant's physical food is not that of the adult, so the intellectual, moral, and religious pabulum of the child is not properly that of the mature individual. Psychology gives us a scientific basis for requiring the child to speak, understand, and think as a child, while expecting the man to put away childish things.

Especially in the field of religious education is it imperative to take into account the needs of childhood and youth, and it is precisely these early religious needs that have been persistently ignored. As President Hall says,[1] "From the old New England Catechism to President Eliot's latest pronouncements reducing religion to ethical culture, American educators have to an extraordinary degree ignored the nature and the highest needs of the child, and persistently assumed that whatever was good for them was, of course, good for him."

There is little agreement as to just what the child's religious needs really are. The only certain way of learning the best methods of education is that of observation and experimentation. In religious education, however, there has been very little unprejudiced observation, as yet, and still less experimentation; but, in the meantime, while we are learning religious educational psychology, society has the immediate task of educating its youth. Consequently partially verified hypotheses must be adopted tentatively and tried out. Among these partially verified hypotheses is that known as the theory

[1] G. Stanley Hall, *Educational Problems*, Vol. I, p. 146.

of recapitulation, or the biogenetic law. This theory possesses its greatest value when applied to the problem of religious and moral education. According to this theory the beliefs characteristic of the primitive religions would possess value for the child, while only later in his development would the teachings of the higher religions become suitable.

My purpose in discussing the value of religious beliefs in individual development, beliefs of different kinds for different stages of development, is to combat two tendencies in present-day practice. One modern tendency is to give the child and youth absolutely no religious instruction. Many parents who have no religious beliefs themselves oppose the teaching of religion to their children on the ground of its untruth. If, as Professor Leuba has shown,[2] the majority of scientists do not believe in even the most essential of religious objects, God and immortality, it is probable that many of them would oppose the teaching of religion to children for the reason that, as they think, religious beliefs are false. Against such a view I would urge the teaching of religion for reasons of its value, regardless of its truth. Another class, the class of religious believers, would, in many instances, teach children the very same religious views that they think fit and proper for adults; and I would urge against this tendency the fact that the religious needs of the child are not the same as the religious needs of the adult.

I

The similarity between early human embryonic stages and lower forms of life was observed by embryologists early in the nineteenth century, and the theory of recapitulation was first clearly stated in its full evolutionary context by Fritz Müller in 1863, and then by Haeckel, under the name of "the fundamental law of biogenesis". Haeckel's statement of the law is as follows:[3] "The rapid and brief ontogeny [the life history of the individual] is a condensed synopsis of the long and slow history of the stem (phylogeny): this synopsis is the more faithful and complete in proportion as palingenesis [the reappearance or repetition of old, ancestral traits] has been preserved by heredity, and cenogenesis [deviation from the phylogeny of the group] has not been introduced by adaptation." This statement includes both the general law and its limitations. Each individual in its development repeats

[2] J. H. Leuba, *The Belief in God and Immortality.*

[3] Ernst Haeckel (Joseph McCabe, translator), *The Evolution of Man,* Vol. II, p. 357.

its ancestral history, but not precisely. Many ancestral traits are lost, new traits appear, and there are numerous short-cuts.

Though it is not maintained by any biologists that the individual in all the details of its development climbs up the ancestral tree, still the theory in its broad outlines is accepted by practically all biologists. That this is true is shown by the fact that the theory is incorporated in the standard textbooks of biology and zoology. Human development, viewed in the light of this theory, is seen to be through stages represented ancestrally by the protozoa, by a radially symmetrical stage, by bilaterally symmetrical forms of life, by fish, by amphibia, and by simian forms, before the individual becomes relatively human at about the end of the second year. Such facts, unquestioned by biologists, are so significant that anthropologists and psychologists have carried the law of biogenesis further, to cover mental development through childhood and youth. There is not so clear a case for mental recapitulation, yet it is denied by few, and it is explicitly accepted by many. Thorndike[4] is one who denies the applicability of the biogenetic law to human development, but his arguments against it are very inconclusive. He does little more than point out limitations of the theory, and everybody admits that the theory has limitations. Thorndike himself, however, accepts the theory in some cases.[5] Baldwin,[6] Hall,[7] and Freud[8] are among the most conspicuous psychologists who accept and employ the doctrine. President Hall perhaps carries it to somewhat extreme limits in many cases, and yet his application of it to religious education is of inestimable value. Mr. Guillet[9] has made a thorough survey of the theory in its general application to education. Professor Coe[10] employs the theory in his discussion of religious and moral education.

If not carried out in too extreme detail, the theory of recapitulation is of at least some service in explaining child

[4] See E. L. Thorndike, *Educational Psychology*, Vol. I, *The Original Nature of Man*, Ch. XVI.

[5] *Op. cit.*, Vol. II, p. 99.

[6] J. M. Baldwin, *Mental Development in the Child and the Race; Social and Ethical Interpretations; A Genetic Theory of Reality.*

[7] G. Stanley Hall, *Adolescence*, 2 vols.; *Educational Problems*, 2 vols.; and other works.

[8] See especially Sigmund Freud (A. A. Brill, translator), *Totem and Taboo*, New York, 1918.

[9] Cephas Guillet, "Recapitulation and Education," *Pedagogical Seminary*, Vol. VII (1900), pp. 397-445.

[10] G. A. Coe, *Education in Religion and Morals.* See especially pp. 211-25.

development. In the first two or three years of life, the foetal stage included, the individual recapitulates the pre-human stages of evolution. Phylogenetically, pre-human stages represent an evolutionary period many times greater than the period during which man has existed. Yet we observe that the individual spends a much longer time recapitulating human than pre-human stages. This, however, is in accordance with the general operation of the biogenetic law. The oldest forms of racial life are recapitulated most rapidly, and the more recent ancestral forms, more slowly. The length of time taken to recapitulate a period does not depend upon the phylogenetic duration of the period so much as upon its recency in the ancestral series. It is to be expected, consequently, that the recapitulation of the human racial stage, representing perhaps a duration of a million years, should take a much longer time than the recapitulation of all the pre-human phylogeny, though this represents a period of many million years.

President Hall divides the stages of individual development into four periods, which he calls those of infancy, childhood, youth, and adolescence. The stage of infancy, lasting until the end of the second year, which has been called the simian stage, does not concern us now, nor does the fourth stage, of adolescence, occurring from the age of about thirteen to twenty-five or thirty, except the first few years of its beginning, for recapitulation does not occur after the beginning of adolescence. It is the stage of childhood, from two to eight, and that of youth, perhaps better called that of later childhood, lasting from eight to twelve or thirteen, that are of greatest importance for our immediate study. The age of childhood, with its imaginative activities, represents the savage stage, marked by a close relation to nature and a tendency to personify physical objects and to confuse the animate and the inanimate. The period of youth represents racially, according to President Hall, the culmination of a long line of savage development—a long and relatively stationary period in racial history. This is the age pre-eminently of physical activity and practical adjustment. In adolescence the stage of later civilization in the race gains ascendency in the individual, and here the emotions tend to predominate.

The plan of education on a recapitulatory basis is to furnish to the developing individual, as far as this is possible, the appropriate environment for his stage of development. In religious education this means encouraging the natural succession of religious beliefs, just as they have occurred in the history of the race.

Religions may be divided historically into nature and redemptive religions. The chief distinction between the nature and the redemptive religions may be expressed in terms of the difference between human desires for satisfactions of a temporal and earthly sort, and desires for transcendent satisfactions. The earliest, pre-animistic forms of religion, the later forms, dominated by a generally animistic philosophy, both belonging to the tribal stage, and the later national, and more or less legalistic religions, such as are best illustrated by early Judaism, would all be included under nature religions. Early Judaism is a nature religion for in early Judaism Jehovah existed for the affirmation of "this world." Such religions as Zoroastrianism, Mohammedanism, Brahmanism, Buddhism, Judaism in its later development, and Christianity, are called redemptive religions. There is a clear and recognizable distinction between those religions in which gods are invoked to satisfy man's desires for material prosperity, and other religions that offer satisfaction to man's desire for "the peace that passeth understanding."

It is possible further to distinguish two classes within the nature religions, that is, the primitive and the morality religions. The morality religions, best exemplified by early Judaism, are still nature religions, but they have advanced beyond the stage of the primitive religions, because of the development and moralizing of the gods, and especially through the rise of some form of monotheism. There is a moral element in the primitive religions, *e. g.*, in taboo, but such a moral sanction is more or less incidental, and is clearly on a lower plane than the morality of the Mosaic code. Thus we may arrive at a three-fold classification of historical religions, like Siebeck's,[11] including (1) primitive, (2) morality, and (3) redemptive religions. Such a classification is best for furnishing a background for the recapitulation theory.

Roughly corresponding to the three stages of religious evolution in the race, there may be distinguished three stages of individual development. Childhood and the early part of what President Hall calls youth correspond to the stage of the primitive religions. The period of youth, especially the later part, corresponds to the stage of the morality religions. The beginning of adolescence marks the rise of the redemptive religions in the race. Such a correspondence, obviously, holds only in a general way. There are wide variations from it for individual differences are great. It is an ideal correlation,

[11] *Cf.* Hermann Siebeck, *Lehrbuch der Religionsphilosophie*, pp. 52-161.

which is never realized completely, but there is value in trying to approximate it.

Childhood and youth, according to the theory of recapitulation, are stages of external authority, for they correspond to times in racial history when the individual was wholly subject to taboo, to the "folk-ways," and to priestly control. During adolescence moral sanctions should lose their external character. Beliefs in taboos have their place in childhood, because of their moral influence; and in youth belief in a God of law, whose commands are right because commanded, likewise possesses positive moral value. A recapitulatory scheme of religious and moral education furnishes a basis for discipline in the early stages of development. Out of the imaginative nature worship of the child there should be allowed to grow a conception of a God who is the author of inviolable law. Belief in a stern God of law should only gradually give place to belief in a God of love at the time of the emotional awakening at the beginning of adolescence. However impracticable the theory may seem, since such discipline is implied by it, it has actually been practiced, deliberately or unconsciously, more extensively than is commonly supposed.

The early belief in taboos, and, growing out of this, the belief in God-given codes of law, are instrumental to the maintenance of desirable forms of conduct during early life, and to the formation of good habits that will persist after the disciplinary beliefs that once supported them have disappeared. As it was with the race, so it should be with the individual. Moral education should begin with taboo, and belief in a God of external authority is the strongest support of morality at the dawn of adolescence. As Partridge says,[12] summarizing President Hall's view: "The wide-spread view that morality can be taught without religion is wrong. . . . Children must have a sense of God as giver of laws, whose demand is right because He wills it; and certainly at adolescence, there must be religion to guide the moral life, if at no other time."

The maintenance of a legalistic stage in the religious development of children may seem at first thought like the imposition of undue rigor and sternness, approaching ascetic discipline. A certain degree of asceticism, however, is defensible, and necessary for the sake of future gain. The universe does not grant immediate satisfaction to all of man's desires, and the habit of accepting with calmness the evil with the good should be established early. An element of

[12] G. E. Partridge, *Genetic Philosophy of Education*, p. 185.

Stoicism is needed in every stable character, and the discipline of early religious beliefs is valuable as a means to the attainment of such a character. James inquires:[13] "Does not.... the worship of material luxury and wealth, which constitutes so large a portion of the 'spirit' of our age, make somewhat for effeminacy and unmanliness? Is not the exclusively sympathetic and facetious way in which most children are brought up today—so different from the education of a hundred years ago, especially in evangelical circles—in danger, in spite of its many advantages, of developing a certain trashiness of fibre? Are there not hereabouts some points of application for a renovated and revised ascetic discipline?"

II

The questions of discipline and of the value of taboo and of beliefs in legalistic religions are questions that merit consideration by themselves. Freudian psychology may be able to contribute something towards a solution of the problem.

There is among educational theorists and others at the present time a somewhat general tendency to rule out discipline, in favor of methods that will allow free self-expression, with trial and error as the first of the ways whereby the child is to learn what is right and wrong. Thus Professor Holt[14] argues against taboos for children. He contends that unless the child is allowed to follow up his impulses to their conclusions, and to learn avoiding reactions in the case of undesirable and dangerous objects through experience with the objects themselves, the proper integration of reflexes will not occur to make later conduct reliable. This is all true within limits: but in many cases the bad consequences of an act are so long deferred that the child will never associate the consequences with the cause; or the consequences may in some cases be immediately disastrous, or perhaps fatal. In such cases the child learns nothing from the experiences, or else learns at too great a cost.

Professor Holt's argument against taboo is inadequate for it is based upon an inadequate conception of taboo. His example of taboo is not an instance of taboo at all. He argues that, in the case of the child who is forbidden by the mother to touch the flame, the child's behavior becomes a function,[15] not of the flame alone, but of the situation—the flame plus

[13] William James, *The Varieties of Religious Experience*, p. 365.
[14] E. B. Holt, *The Freudian Wish*, Chs. III, IV.
[15] See Professor Holt's definition of behavior, *op. cit.*, Supplement, "Response and Cognition," pp. 153-208.

the mother. From this it follows, Professor Holt says, that in the absence of the mother, who is the source of the taboo, the child will burn himself in the flame. But this is not a case of taboo at all. Taboo involves belief in some superhuman, invisible intervention in the event of doing a forbidden act. So, in the case of genuine taboo, there is no harm caused by behavior becoming a function of the object plus the taboo-character of the object. The source of the taboo is always present, and safe conduct is thereby assured. In later life the belief in many, perhaps all, earlier taboos will disappear, but proper conduct will continue in most instances for two reasons: first, because the correct habits that have been formed under the influence of taboo will tend to persist and to act just as mechanically as original instincts; and second, because, for the more mature individual, new and adequate rational sanctions for the continuance of the acquired type of conduct arise and take the place of the original taboos. No harm results even if all taboos do not disappear, for, as James says,[16] "The highest form of character, . . . absolutely considered, must be full of scruples and inhibitions."

The two most fundamental instincts, from which the other instincts have developed, are the food-getting and the sex instincts. The regulation of the sex instinct is one of the constant problems confronting society. I would contend that, just as all education in sex morality[17] in the race began in taboo, so sex taboo of some sort is necessary for the maintenance of desirable standards of conduct during the formative stages of individual development. Münsterberg[18] argued for a certain amount of taboo in sex education. McDougall[19] advises against too great a rationalization of the sex problem in early education. And Freud recognizes the necessity of inhibitions for physical and moral reasons, as a part of the sublimation process.

Freud insists upon the necessity of early sublimation of sex energy into socially useful channels; and sublimation, though positive, requires as its correlate a negative factor to check the primary expressions of sex in children. A recapitulatory theory of religious education provides both the negative factor, some sort of taboo or religious interdiction, and also the positive conditions that favor sublimation through supplying the growing individual with an environment suited to call out

[16] *Talks to Teachers*, p. 179.
[17] See Ernest Crawley, *The Mystic Rose*.
[18] *See Psychology and Social Sanity*, pp. 17-19; 59-61.
[19] *Social Psychology*, 8th edition, pp. 419-21.

such activities as are socially acceptable and also in accord with the developing interests of the individual. Harm would result if the primitive desires and activities of children were forbidden, and at the same time no new positive interests were encouraged; but, along with the encouragement of new, socially desirable activities, undesirable tendencies must be discouraged.

On Freudian principles religion is a valuable form of sublimation, especially at the beginning of adolescence, as well as earlier. Freud says,[20] "Owing to the oppositional relation existing between culture and the free development of sexuality, the results of which may be traced far into the formation of our life, the problem how the sexual life of the child evolves is . . . of very great importance in the higher stages of culture and civilization." Sublimation is the process by which sexual energy is utilized in other, non-sexual spheres, and in directions that are more approved of by society, and that are ultimately of more value for the individual as well as for society. Art and religion are the chief forms in which sublimated sex energy expresses itself.

According to Freud, the child is "polymorphous-perverse" in his sexual predispositions. That is, in his earliest years he has tendencies towards homo-sexuality, exhibitionism, sadism, masochism, etc. It is through sublimation of these perverse tendencies that normal sexuality and a moral character are developed. The "sexual latency period," from about the fourth year to the beginning of puberty, is the time when repression of perverse tendencies, and sublimation, are necessary. Inhibition of the early tendencies is necessary if neurotic disturbances are to be avoided in later life. Both normal and neurotic adults possess repressions in some degree. In neurotic individuals the repressions are not complete, and they consequently manifest themselves as symptoms of the neuroses, while in normal, healthy individuals repressed wishes are inert, or else they manifest themselves only in dreams. Repression alone, without sublimation, or substitution, will always have bad results; but Freud and most Freudians recognize the necessity of social and religious restraints, inhibitions, and taboos, as a part of the normal sublimation process. Thus Brill says:

"Were it not for the severe checking the individual constantly experiences from the very beginning of his childhood, which causes him to give up most of his desires, it would be impossible to live in any society, savage or enlightened. . . .

[20] Sigmund Freud, *Three Contributions to Sexual Theory* (A. A. Brill, translator), p. 85.

"This inhibiting process begins in childhood and is continued throughout life. . . . Throughout the whole course of our existence, society (religion and ethics) teaches us to curb our desires and to give up what we want. We want much and we get comparatively little, but *we never stop wanting.*" [21]

"Civilization, so-called, simply consists of inhibitions imposed upon the individual by religion and society. The more one can inhibit his primitive impulses, the more cultured he is, and savages and children must be taught inhibition to fit them for society.[22]

There is no virtue, of course, in curbing desires except for the sake of greater satisfactions; and it is for precisely this result that many of the desires of early childhood should be repressed and sublimated. Later health, not only moral, but also physical, requires sublimation, according to Freud. Whether the activities of the child shall develop into socially acceptable forms, depends upon the success that attends sublimation. Later neuroses result from unsuccessful sublimation and repression.

Freud's psychology has a very distinct recapitulatory background. This is shown especially in his book, *Totem and Taboo,* as is suggested by the sub-title, "Resemblances between the Psychic Lives of Savages and Neurotics." Since the adult neurotic individual represents a continuation of, or reversion to, psychic infantilism in the sexual life, the normal child is on a mental plane corresponding to that of the savage. What is normal for the savage and for the child, is a symptom of disease in the civilized adult.

Freud probable overemphasizes the rôle of the sex instinct in the economy of life, both in healthy and in diseased conditions. Such is the opinion of many critics. But critics such as McDougall,[23] while rejecting Freud's extreme emphasis upon the centrality of sex, are glad to accept his notion of sublimation. Suppression of the primary forms of sex expression, and sublimation of sex energy into more desirable channels under the guidance of religious belief, have definite results of great value, as McDougall points out.[24]

Much of the early sublimation in later childhood would, in an ideal scheme of things, take place under the influence of religion of the legalistic sort. Then at adolescence sublimation would result, as it actually does in numerous cases,

[21] A. A. Brill, *Psychanalysis,* p. 40.
[22] *Ibid.,* p. 263.
[23] *Op. cit.,* Supplementary Ch.,II, "The Sex Instinct."
[24] *Ibid.,* p. 424.

in a development into a new stage of religion, the stage of the redemptive religions. As McDougall says.[25] "The intensification of thought and feeling due to sublimation may affect principally the religious interests, and then becomes a main condition of the conversion which is so characteristic of adolescence." So it is seen how religious beliefs corresponding to beliefs of the legalistic stage in racial evolution have positive value at the beginning of adolescence in guiding the moral life and in causing continued sublimation and a normal growth into the redemptive stage of religion. In the words of President Hall: "Adolescence... is a period when, whatever may be the truth about it, it is a wholesome pedagogical method to apply a transcendental, supernatural cult."[26] "Religion, which has been the chief agent in regulating it [sex] in the past, must also be looked to in the future."[27]

During early adolescence religious belief has a pronounced moralizing influence from the fact that the attribution of the new experiences, which are more or less inevitable at this time, to "higher" sources lends a seriousness and even sacredness to the experiences and to life as a whole. On the other hand, the individual who, with truer scientific insight, perhaps, attributes his new experiences of early adolescence wholly to physiological processes, largely of a sexual nature, possessing no religious significance at all, fails to get the inspiration of high moral ideals that are so valuable at this stage of development. It would probably be truer for the adolescent convert to ascribe his experience of conversion to a sexual source, but it is more valuable for him to believe that a religious significance attaches to the experience. One belief tends to elevate the character; the other tends to destroy the practical idealism of the adolescent period. The new emotions may be interpreted grandly or meanly, from "above" or from "below," idealistically or physiologically. For those experiencing the emotions there is value in the idealistic and religious way of interpreting the experiences.

III

I prefer my conclusion to be like that of some of Plato's dialogues—one in which nothing is concluded. I have sought chiefly to call attention to a sometimes neglected factor in education. The question of moral discipline divides American educational theorists into two camps. Professor Dewey

[25] *Ibid.*, p. 424.
[26] "College Philosophy," *The Forum*, Vol. XXIX (1900), p. 412.
[27] *Educational Problems*, Vol. I, p. 460.

represents one tendency, which is, in general, opposed to discipline. President Hall and his followers represent another tendency, which lays emphasis upon moral discipline. The truth probably lies somewhere between these divergent views.

It is claimed by Dewey and his followers that democracy and discipline are contradictory. Discipline is supposed to go only with an autocratic and militaristic form of society. The leading aim of American education, good citizenship in a democracy, if it is to be achieved through the operation of the principle of learning by doing, requires, it is claimed, that children, the citizens of tomorrow, shall learn the democratic principles of self-government by governing themselves today. President Hall accepts the theory of recapitulation as the basis of his view that a certain amount of discipline is necessary in the moral training of children. Such a view maintains equally with Dewey's that democratic citizenship is an important educational aim, perhaps the one most comprehensive aim in American education. It would point out, however, that democracy is the latest stage in racial evolution, a stage which is still in process of becoming established, and that individuals in the immaturity of their childhood and youth ought to relive the earlier life of the race, with its priestly control and its external constraints, before being fitted to take up the duties belonging to the highest stage of racial development.

Recognizing that the theory of recapitulation implies moral discipline, Dewey no longer accepts it,[28] though he did so earlier.[29] As a matter of fact, an acceptance of the theory, with its implied discipline, does not contradict democratic principles; it simply prescribes a postponement of their application in the nurture of children.

[28] *Democracy and Education*, 1916, pp. 84-89.
[29] *The School and Society*, 1899, p, 62.

THE BIOLOGICAL VALUE OF RELIGIOUS BELIEF

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Whether God, freedom, and immortality are realities or not, of one thing there is no question: it is a fact, for any observer to take note of, that in many minds there exists the belief in these objects. Religious beliefs are real as psychological entities regardless of the ontological status of the objects of the beliefs. It would be possible to construct a philosophy of religion wholly upon the fact and the value of religious belief, without raising the further question of the existence of the objects believed in, or even if we assumed the unreality of such objects. Beliefs may exist and have value for those who hold them as true even though they are entirely false, since the subjective effects of beliefs are independent of the question of truth; and it is even possible that religion is too good to be true.

Religion would continue in the world indefinitely upon the sheer basis of belief as a psychological fact—a biologically justified fact—even if the whole scientific and philosophical portion of mankind had agreed in branding all religious objects as unreal. James expresses the emotional necessity of religious beliefs for the majority of people when he says,[1] "Materialism and agnosticism, even were they true, could never gain universal and popular acceptance; for they both, alike, give a solution of things which is irrational to the practical third of our nature, and in which we can never feel volitionally at home." Careful observers would have said, before Professor Leuba's recent study[2] of the actual religious beliefs of American scientists showed that it is so, that the majority of scientists do not believe in God or immortality. This fact is not so significant for the future of religion, however, as the fact that the majority of the parents of each new generation do have religious beliefs. The parents and homes, the churches and general social background, of each new generation, exert a greater influence upon the religious beliefs of people than do a few scientists who have ceased to require religious belief

[1] Wm. James, *The Will to Believe*, p. 126.
[2] J. H. Leuba, *The Belief in God and Immortality.*

in order to maintain their vital equilibrium. Making the whole world scientific is a hopeless task.

Beliefs exert a potent influence on life. The psychological and physiological effects of belief are shown strikingly in cases of primitive taboo where the *belief* that a taboo has been violated has, in numerous instances, caused death. World-views—beliefs about the ultimate things in man's total environment—are important influences on the physical economy of life. If two nations or races are equal in all respects except that the general philosophy and religion of the one is optimistic, and of the other, pessimistic, the race with the optimistic beliefs will survive in the struggle for existence, while the other race will be driven to the wall. As Goethe says:[3] "The real and sole theme of the history of the world is the conflict between belief and unbelief. All epochs in which faith reigns supreme, under whatever form it may be, are bright, uplifting, and fruitful for contemporaries and posterity. All epochs, on the other hand, in which unbelief, in any form, gains a weak victory, even though temporarily boasting a sham glory, will pass away."

Several writers have given clear expression to the biological setting of religious belief. Professor Leuba says:[4] "The mere belief in gods may of itself produce results sufficient to make of religion a factor of the highest biological importance." "The biological point of view affords the more fruitful outlook. From this point of vantage religion appears as a part of the struggle for life." "Morality and religion . . ," says Professor Carver,[5] "must be regarded as factors in the struggle for existence as truly as are weapons for offence and defence, teeth and claws, horns and hoofs, fur and feathers, plumage, beards, and antlers." "Who are the chosen people is not a historical question. It is a question of fact, adaptation, and survival. What is the true church will never be determined by archaeological and historical investigation. It will be determined by the laws of selection and survival." Of the actual religious beliefs of the past, Read says,[6] "Religion, in spite of its many drawbacks, has been so useful that families and tribes have been selected by their addiction to it."

The very fact of the existence of religious beliefs among all primitive peoples establishes a presumption in favor of the biological value of such beliefs. If at any time there have existed

[3] Notes to *Westöstlicher Divan*, quoted in Paulsen's *System of Ethics* (Thilly's translation), p. 425.
[4] J. H. Leuba, *A Psychological Study of Religion*, pp. 14, 16-17.
[5] T. N. Carver, *Essays in Social Justice*, pp. 20, 31.
[6] Carveth Read, *Natural and Social Morals*, p. 226.

savage peoples without religious beliefs, they have not survived long in the struggle for life. All the peoples that have survived have possessed, among other things, religious beliefs. From this fact the evolutionist at once infers that religious beliefs must have been of some important service to the race. It might be argued against this by some objectors that the races which have survived have survived by virtue of other kinds of vital fitness, so that religious beliefs have counted neither for nor against survival. It is true that some organs exist the utility of which is not apparent. Since such variations have at least had no disutility, they have not been eliminated through the elimination of the organisms possessing them. But belief is of such practical importance that it can not by any possibility be regarded as neutral, that is, of no influence, favorable or unfavorable, in the struggle for existence. Consequently the universal existence of religious belief among primitive peoples is evidence of its survival value.

Some critics might admit that religious belief has been valuable in the past, during the infancy of the race, while they would argue that, like the vermiform appendix, it has outgrown its usefulness, or has even become a source of injury. G. E. Moore, for example, speaking of religious belief in modern society, says that "there is at least good room to doubt whether it ever does much good." [7] It can be shown, however, that religious belief still possesses value.

I would repeat that the question of truth is irrelevant to a discussion of the value of religious belief. I am studying the value of beliefs in their psychological context, without regard to the logical matter of truth. Actually, most of the early religious beliefs have had unreal objects, as all would agree, but their value is not thereby vitiated. Thus Read says,[8] "As for the falsity of a whole religion in its peculiar doctrines, that (I fear we must admit) does not necessarily render it debasing or pernicious; for we have here an extreme case of that astonishing phenomenon in human life, the utility of illusion." And Rashdall says in like manner, "Error and delusion may be valuable elements in evolution;—to a certain extent . . they have actually been so." [9] Primitive religions have been the cause of many evils, it is true, but such evils have been more than counterbalanced by numerous positive values.

[7] "The Value of Religion," *The International Journal of Ethics*, Vol. XII (1901-02), p. 97.

[8] *Op. cit.*, p. 229.

[9] Hastings Rashdall, *The Theory of Good and Evil*, Vol. II, pp. 209-10.

I said above that religious belief cannot be regarded as a neutral factor in the struggle for existence. The enormous effect of strong belief is well illustrated by instances of violated taboos among primitive peoples. Frazer cites many striking examples.[10] A Maori slave, upon being told that the food which he had eaten had belonged to a chieftain, and was therefore taboo, " was seized by the most extraordinary convulsions and cramp in the stomach, which neevr ceased till he died about sundown the same day. . . A Maori woman having eaten of some fruit, and being afterwards told that the fruit had been taken from a tabooed place, exclaimed that the spirit of the chief, whose sanctity had been thus profaned, would kill her. This was in the afternoon, and the next day by twelve o'clock she was dead." There is on record a case of a negro who ate a wild hen, which was taboo, upon the supposition that it was a domesticated fowl. Four years later he was told by his former host what he had eaten, whereupon he " immediately fell a-trembling, and suffered himself to be so far possessed with the effects of imagination, that he died in less than twenty-four hours." Many other instances of a similar sort are cited by Frazer. Such examples of the effects of belief in the case of violated taboos illustrate the general potency of belief. In the majority of cases, of course, taboos are not violated, on account of the beliefs about the consequences of violation, and so the race here receives its first moral instruction.

Though the hygienic value of optimistic religious beliefs in the case of the higher religions is important enough to make of religion a significant factor in the struggle for existence, religious beliefs have been of biological utility to a greater extent through their moral influence. In such forms of the higher religions as Catholicism, both the moral and hygienic values are important. There are certain standards of conduct that are justified by the forces of natural selection, and it seems to be a fact that religious beliefs are the only sufficient instrumentality permanently to maintain these standards. McDougall says [11] that the belief in immortality, which is one of the most central of religious beliefs, is essential to the survival of any nation because of its moralizing influence upon thought and conduct.

Some writers have attributed the beginnings and even the continued maintenance of all morality to religious belief.

[10] J. G. Frazer, *The Golden Bough*, 3rd edit., Part II, *Taboo and the Perils of the Soul.* See pp. 135, 137.
[11] Wm. McDougall, *Body and Mind*, Preface, pp. xiii, xiv.

Thus Pfleiderer says,[12] "The historical beginning of all morality is to be found in religion." And Caird says,[13] "Religion and morality are necessary correlates of each other." Such extreme views are untenable, for certainly in modern society religion is not an essential condition of morality *with all men,* and in primitive society many kinds of right conduct have an instinctive basis, especially in the family relationships. Nevertheless, religious belief has enhanced primitive morality, and continues, on the whole, to possess positive moral value.

Primitive morality is fundamentally a matter of the customs, or *mores,* of the group. Morality is always and everywhere a social phenomenon, arising from the interaction of individuals in groups. A group of Hobbesian individuals is biologically inconceivable. Man, like most of the animal kingdom, possesses various social instincts. Group selection[14] has tended to eliminate all of the too self-centered individuals. Since a group is stronger than an individual in the struggle for existence, only groups have survived; and furthermore, the existence of groups requires the presence of social instincts in the individuals that make up the groups. Altruism is just as instinctive as egoism, and is probably derived from the parental instinct. In many of the lower animals the social instincts manifest themselves in various forms of gregariousness and mutual helpfulness, and much more is this the case with man. Thus primitive man is fitted for moral life within groups by his aboriginal inheritance.

Acts are judged right or wrong by primitive man according as they conform or not to the group customs. So far as primitive customs are instinctive in origin, they have survival value, on the whole, since the instincts are one of the products of the struggle for existence. Religious beliefs enter, however, and complicate the situation. Many of the customs have a religious origin, and others are enforced by religious beliefs, especially by beliefs in taboo. Taboo is the original categorical imperative. It corresponds, in upholding early customs, to the "thou shall not" of the Mosaic code. Taboo is chiefly religious in origin, being based upon the belief in awful and mysterious penalties that will inevitably follow the infringment of certain rules. Since primitive morality consists of primitive customs, taboo is instrumental to primitive morality

[12] Otto Pfleiderer, *Philosophy of Religion* (Stewart and Menzies, translators), 4 Vols., Vol. IV., p. 230.

[13] Edward Caird, *The Evolution of Religion,* 2 Vols., Vol. I., p. 237.

[14] See P. Kropotkin, *Mutual Aid, a Factor in Evolution;* Edward Westermarck, *The Origin and Development of the Moral Ideas,* Vol. II, Ch. XXXIV; Wm. James, *Principles of Psychology,* Vol. I, p. 325.

through enforcing the *mores*. There are other means, such as public approval and disapproval and physical force, of enforcing primitive customs, but belief in taboos is one of the very strongest guardians of primitive group morality. Primitive customs have possessed some disvalue, through hindering progress, but they have had positive survival value on the whole; and taboo, in enforcing customs, has possessed value in the struggle for existence. Furthermore, the primitive *mores* have contained the germs of much of our present morality; and taboo has, therefore, been instrumental to the maintenance of conduct that is right, as judged by modern standards.

There have been other values of early religious belief. Religious belief has had what may be called industrial value so far as the industrial arts have developed in connection with the worship of the gods. Religious belief has had scientific and philosophic value so far as pure science and philosophy have developed from religion. The belief in spirits, hero-ancestors, gods, etc., by increasing the extent and complexity of primitive man's environment, has stimulated intellectual activity in dealing with the world. The worship of heavenly bodies has at least attracted serious attention to them, and consequently the science of astronomy owes something to early religious interests. Mythological accounts of the origin and nature of the world have stimulated curiosity about scientific questions, and have given place to more scientific cosmogonies and cosmologies. The various professions have had a religious origin. Priests and chieftains are often identical among primitive peoples. The medical profession has evolved from the work of medicine men. The first teachers were the priests and head-men, who gave instructions to the youth in the initiation ceremonies. There has been a close historical connection between theology and philosophy; and the early religious interest, first becoming intellectualized in the form of theology, has always tended to go over into general philosophy.

Among other values of early religious belief are artistic, social, and legal, or political, values. Primitive religious beliefs have had artistic value so far as poetry, music, sculpture, and architecture have developed out of the service of the gods. Dancing and music were originally of religious significance. The drama traces its origin to religious ceremonials. The first poetry consisted of stories of the gods. The first architecture worthy of the name arose in the construction of altars and temples. In the creation of images of the gods, sculpture appeared. Early painting represented the deeds of the gods and

of ancestral heroes who had been deified. Social value has attached to early religious beliefs so far as the beliefs have been a bond uniting groups in the worship of common deities, supplementing the instinctive basis of group unity. Legal and political values of early religious beliefs appear in the development of property rights and stable forms of government. Taboo has played an important part in the development of rights of property. Holy places are at first the property of the gods. In the case of taboo on chiefs, it is sometimes the case that everything that a chief touches becomes his property. It is of importance for social evolution that the conception of property rights should have arisen early. More obvious is the connection between religion and government or law. The legal profession was originally undifferentiated from the priesthood, and the first laws of the state were religious laws.

Not only the moral value of early religious beliefs, but also the other values, which I have called industrial, scientific, artistic, social, and legal, have been genuine values of a biological sort. They have all possessed evolutionary utility.

The most fundamental distinction between the lower, nature religions, and the higher, redemptive religions may be expressed in terms of the difference between desires for satisfactions of a temporal and physical sort, and desires for transcendent satisfactions. In the nature religions, man is satisfied if he has worldly prosperity; and he believes in and desires transcendent realities only as instruments to the attainment of his worldly desires. It was not until a considerable degree of civilization had been reached that the redemptive religions could appear and maintain themselves. Natural selection, perhaps, accounts for the suppression of interests of a redemptive sort in the periods of prehistoric savagery and of primitive culture, through eliminating any idealistic individuals that may have appeared. A Wordsworthian is not the kind of nature worshipper that would be fit to survive among primeval savages; but, in a social order of more refinement, idealistic beliefs possess a positive biological value for many individuals.

In the higher developments of the religious consciousness, the hygienic value of religious belief, which now becomes instrumental to optimism and hence to health and survival, is perhaps a more important value than the moral value, though the latter is still significant. The complete denial of the existence of the objects of religious beliefs would reduce a large portion of mankind logically to the acceptance of Mr. Russell's statement,[15] "Only on the firm foundation of unyielding des-

[15] Bertrand Russell, *Philosophical Essays*, p. 61.

pair, can the soul's habitation henceforth be safely built." This would be the logic of the situation, but not the "biology" of it. Despair means death, literally. A race that despaired would perish from the earth; but a hopeful faith means life, and gives life abundantly. Faith is biologically necessary for the human race, and it is a psychological fact that "hope springs eternal in the human breast." Mr. Russell's statement is contradicted by the facts of biology and psychology, for on a foundation of despair no habitation at all for the soul can possibly be built.

Such a pessimism as Mr. Russell's is due as much to the pessimist's high ideals as to his beliefs about the objective nature of reality. Pessimism results from the belief in a fundamental misfit between reality and the objects of desire. The man who is content to be a brute, with a brute's desire, is not pessimistic if he finds the world fundamentally brutal. But to the man aware of the "noon-day brightness of human genius," pessimism comes if he believes that "the lofty thoughts that enoble his litle day" are insufficiently grounded in the ultimate nature of things.

For large numbers of individuals in modern society, belief in the reality of another world of which the physical world is but a shadow and a promise, is essential to optimism and to a healthy state of mind in general. Professor Hocking's assertion[16] that optimism requires the denial of the reality of the world as it appears to be, together with belief in transcendent realities, is justified by the psychological facts so far as many persons (though not all) are concerned. The "*Weltschmerz* bred of reflection," or "religious pessimism," according to James, "consists in nothing but a religious demand to which there comes no normal religious reply."[17] "Its great reflective source has at all times been a contradiction between the phenomena of nature and the craving of the heart to believe that behind nature there is a spirit whose expression nature is."[18] "No brute can have this sort of melancholy; no man who is irreligious can become its prey. It is the sick shudder of the frustrated religious demand."[19]

The inevitable pessimism of naturalism for all persons of sensitive natures who are also reflective, and who take a wide view of reality, has been a frequent theme in prose and in poetry. Some lines in James Thomson's "City of Dreadful Night" express vividly the despair of religious pessimism:

[16] W. E. Hocking, *The Meaning of God in Human Experience*, p. 168.
[17] Wm. James, *op. cit.*, p. 39.
[18] *Ibid.*, p. 40. [19] *Ibid.*, p. 42.

"'The man speaks sooth, alas! the man speaks sooth;
We have no personal life beyond the grave;
There is no personal God; Fate knows nor wrath nor ruth:
Can I find here the comfort which I crave?

"'Speak not of comfort where no comfort is,
Speak not at all: can words make foul things fair?
Our life's a cheat, our death a black abyss:
Hush, and be mute, envisaging despair.'"

James points out two possible ways of relieving such pessimism. "The longing to read the facts religiously may cease, and leave the bare facts by themselves; or, supplementary facts may be discovered and believed in, which permit the religious reading to go on."[20] The first alternative would mean the giving up of religion and the acceptance of a materialistic philosophy. It is true that such a solution is accepted by many persons, but James emphasizes correctly the biological impossibility of the general acceptance of materialistic views by all of mankind.[21] A spiritual view, on the other hand, releases hope and moral courage; and hope and moral courage are among the things men live by. Such religions as Christianity and Buddhism are essentially religions of deliverance from the vanity of worldly desires. Buddhism is pessimistic so far as the physical world is concerned, but its adherents are made optimistic, and so are enabled to survive in the physical world, through their beliefs in transcendent realities.

Browning's optimism was based upon religious idealism. Reality, as he believed it to be, coincided with what he valued most. Abt Vogler's keys gave their sounds to the wish of the musician's soul. In music this "wish flowed visibly forth." The man with an idealistic temperament will be an optimist only if he believes that this "palace of music," the objectification of lofty aspiration, is "founded flat on the nether springs" of reality. The religious idealist experiences all the emotions of spiritual sovereignty, believing, with the creative musical genius of Browning's poem, that "'tis we musicians know." By him, reality is taken to be such as to satisfy all his deepest longings. For him—

"All we have willed or hoped or dreamed of good shall exist;
Not its semblance, but itself; no beauty, nor good, nor power
Whose voice has gone forth, but each survives for the melodist
When eternity affirms the conception of an hour."

[20] *Ibid.*, p. 41. [21] *Ibid., Ch.* IV.

Though man's emotional nature in so many cases requires idealistic and religious beliefs, it by no means follows that such beliefs are true. To maintain that the value of idealism implies its truth would be to commit the pragmatic fallacy.[22] But there is every reason to think that large numbers will continue to accept religious idealism as true, simply because in so many cases man's emotions determine his beliefs. Those who predict the "irreligion of the future" fail to take into account the emotional and temperamental basis of belief. We may correctly conceive of the conflict between religion and irreligion, idealism and materialism, as a biological struggle between the "tender-minded" and the "tough-minded,"—and the biological advantage lies to some extent with the "tender-minded" so far as their emotional cravings are satisfied by religious beliefs. Religious beliefs not only make for optimism, but are also instrumental in motivating moral endeavor; and consequently, in the highest as well as in the lowest forms of religion, religious beliefs have important biological values.

[22] *Cf.* the author's article, "Two Common Fallacies in the Logic of Religion," *Journal of Philosophy, Psychology, and Scientific Methods,* Vol. XIV., (1917), pp. 653-660.

INTELLECTUALISM VERSUS INTUITIONISM IN FRENCH PHILOSOPHY SINCE THE WAR

By Albert Schinz, Smith College

After the war had broken out, and after the first emotions were subdued, and after a sufficient number of facts had been accumulated to justify the resumption of philosophical considerations, decidedly the most striking feature in the writings of those philosophers in France who felt that they could speak for the generations of reconstruction, was an unequivocal *meâ culpâ*. There was no pose in it, as if to win applause from the gallery by grandly acknowledging sins in the past and trying to gain absolution on the ground of this easy confession. No, the sincerity, the earnestness of those men is unmistakable. They say not only: "We have allowed ourselves to be misled;" they say emphatically: "It must not happen again!"

But by whom had France been misled? Some pointed to the politicians, whose criminal shortsightedness in leaving the country unprepared had rendered possible the formidable aggression by Germany. Some pointed to the industrial and commercial men of France, who had not kept pace with the rest of the world and who had allowed the so-called "peaceful" invasion of Germany before the war. And some also pointed to the financiers of France, who had been content to be clever bankers, and had made France rich in money only, and not in economic wealth.

But some went deeper than that. After all, when the government had asked to increase war appropriations, it had met with considerable reluctance—Why? The French people themselves had been willing to forsake material comfort and progress to devote themselves to peaceful, intellectual, and artistic pursuits, to discuss Symbolism and Realism, Cubism and Impressionism—Why? Now, they all had to pay dearly—Why?

According to a very representative group of men, the responsibility rested chiefly with the philosophers whose influence had induced the French people to enjoy a merely contemplative life while other nations were engaged in pursuits of material advantages and of conquest. Just as those philoso-

phers and statesmen, who shape public opinion in Germany had screwed up their people to a state of mad Pan-Germanism, so the philosophers and statesmen of France had lulled their people into a state of dangerous security. This involved not only a state of unpreparedness for the war as waged by Germany since 1914, but a perfect waste of good energy in vain and barren sophistications.

That nefarious philosphy, which must be eradicated, assumed different forms; chiefly three.

1. The first is a *sentimental socialism,* based on a naïve, if fine, belief in an international brotherhood—which the war proved to be, if not false in itself, surely far from realization at the present hour (Jaurès).

2. This Utopian socialism, which appealed especially to the masses, assumed in the bourgeois milieu—which claimed to stand on a level a little higher intellectually—the form of what has been called *Moralism.* Moralism is based upon the assumption that there exists a moral conscience, the same in all men, and that one can depend upon this moral sense, and that it cannot be altered in any nation, under any compulsion. What made things worse was that the French philosophers who, by this Moralism, fought materialism as suggested by scientific men, were very prone to point to German philosophers, especially to Kant. As a German was presented in France as the chief representative of that theory, one took for granted that it was actually prevailing in Germany. The fact, was, however, that Pan-Germanists had replaced the creeds of the moral imperative by their Pan-Germanist creed—but were very glad that the French believed that Kantian ethics still prevailed on the other side of the Rhine. Boutroux would be here the most typical name in France.[1]

3. The third theory is the worst of all. Unfortunately it has the support of the man who won a tremendous prestige in France and abroad in recent years, Bergson. The theory is Intuitionism, and it is perfectly in line with sentimental Socialism and Moralism; indeed it seems to offer for them a metaphysical background. Intuitionism is anti-intellectualism, or if you prefer, subjectivism; it means a philosophy of personal fancy; in one word, it was just the kind of fluid philosophy, destructive of straight, rational, realistic, virile thought, that Germany could wish for France, a philosophy of unmanly sentimentality: nothing could be more deadly to France

[1] The fact that Boutroux has assailed German ethics since, does not change matters. One may be glad that he came to see at last; but Boutroux has never repudiated his own books yet.

than Intuitionism or Bergsonism. *Bergsonism,* in the eyes of the war generation, that is the enemy![2]

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The most striking theoretical discussion hostile to Bergsonism is Julien Benda's vigorous *Sentiments de Critias* (1917). Benda opposes with absolute determination and perfect outspokenness the intellectualism of French thought from Descartes down, to that German thought (sincere, or meant simply to sidetrack an enemy nation), which always leaves something to intuition: In its best form, in post-Kantian transcendentalism, German thought attempts to explain more than human intellect can explain; therefore, it is bound to breed confusion and it has to resort to intuition instead of reason in order to get out of this confusion *somewhere.* "Without doubt, reality is obscure, mysterious at bottom, and no definite idea can exhaust the richness of it. But obscure notions, which are most of the time only confused or equivocal,—pseudo-ideas,—fail likewise to exhaust it, and they threaten, besides, to lead us astray." This quotation from Parodi sums up the contention of the whole energetic book. The introducers of Intuitionism in modern thought are the German Romanticists;—and France would have drifted away from its normal course entirely, had it not been for some men like Comte, Taine, and Ribot. Note that all theories which are not amenable to rational thought, are German: Intuitionism—the theory that might is right; Intuitionism—the theory of the superiority of man waging war; Intuitionism again—the theory of the right of one race to rule over others; and Intuitionism—the theory of State opposed to individual. But, of

[2] It is only fair to say that Bergsonism may be interpreted differently. It was interpreted in a different sense by Péguy, and by young men like Lanux, who emphasized the Pragmatic side of that philosophy. Péguy says: "It is a prejudice, but it is an absolute, ineradicable prejudice, which demands that an inflexible reason should be more a reason than a flexible one. . . . It is evident, on the contrary, that it is the elastic and flexible methods, flexible logic, and flexible morals, which are the most severe, as they adhere the more closely to their object. . . . An inflexible morality may permit crimes to escape from its recesses, while on the contrary, a flexible morality will hold, denounce, and pursue the sinuosities of those things which seek to escape." One may answer, however, "Yes, but if it is so elastic, Bergsonism may as well shelter Bernardism. . . . If Intuitionism requires no rational principles of justice, for instance, why then not as well Might (with the Germans) as Right (with the Allies)? One may venture to say that, had Péguy lived, he would have seen this, and with his characteristic frankness and honesty, written a *Cahier* sharply repudiating his utterances of 1914.

course, Intuitionism—one may say, by definition—works both ways, *all* ways; it works in an imperialistic direction when handled by German statesmen, it works for the pulverization of energies when handled by the subtle mind of a metaphysician of the type of Bergson.[3]

Benda had a particular right to crush Bergson unmercifully. His is not the case of the man who plays the prophet after the event; for he had before the war, voiced his protest against Bergson fetishism (see his *Bergsonisme ou une Philosophie de la Mobilité*).

Benda goes to the bitter end, for he is not quite sure whether Bergsonism *can* be swept away. "We may still witness," he says, "a detestation of a critical spirit for the benefit of lyrism, as the world has never seen it yet . . . without counting the support that such men will be ready to give who see their reputation involved in it, I mean that army of writers who *font de la vibration* but never have the shadow of an idea. This is not very gay for such as only know how to understand." Remark also the significant words: "It is a serious matter to see the official thinkers of a nation, using their authority since the beginning of the war, to endorse errors which they know to be errors; but with which they know that they please their countrymen. . . . And more serious still, to find that the vogue of those thinkers depends now upon such subservience." And still more direct, "B. and B. (Boutroux and Bergson) take good care not to pass judgment on such ideas. . . ."

So, let us change our ways of thinking, and, before all, as regards the war: "The mastery of war, like that of all that is getting more complex, must rely less and less exclusively on art, and more and more on science. Art is entirely master in some matters, only when those matters are still in the stage of infancy. . . . The reason why one wants genius to be always supreme—so that one may expect everything from it—is first, because it allows us to hope for a speedy solution, . . . a little because it flatters laziness; but especially because of that régime of aestheticism in favor today, which lends religion only to phenomena of the instinct and of spontaneity, and considers as of a rather gross nature the will based on system and organization. . . . Would it be allowable to say that under present circumstances a *renverse-*

[3]Words must not mislead us. For example, one speaks often of the *mysticism* of Péguy; but that would mean, in the mind of the young Frenchman, only that Péguy defended with a mystic ardor ideas that were based on so strong rational arguments that there could remain no doubt about their truth; it is Descartes' idea that plain, *rational* evidence is the criterion of truth.

ment des valeurs would seem desirable?" Benda means *Renversement of Intuitionism in favor of Intellectualism.*

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A book of the same order as Benda's is René Lote's *Les Leçons Intellectuelles de la Guerre* (1917). The author of *Les Origines Mystiques de la Science Allemande* (1913), *Du Christianisme au Germanisme* (which he says was written in 1911, although published in 1914), is only, if possible, more pitiless than Benda against those who, in his opinion, have poisoned French intellectualism with fanciful metaphysicism. The whole volume is an ardent plea for return to clear, sensible thinking, as existed during the seventeenth and eighteenth French century; it is a thorough attack against Romanticism, and beyond it against Rousseau-sentimentalism: the latter's obscure thought makes of the Ego the center of the world and justifies passion.

The book is dedicated to Seillière; it continues the trend of thought inaugurated by Seillière, Lasserre, and Maurras, or even before them by Brunetière, Bourget, and Lemaitre. But, in some way, the note is different from that of the forerunners of twenty or ten years ago. It is not a narrow-minded attack on scientists whose theories were interpreted in terms of materialism in ethics, nor is it made to be a furious attack based on passion rather than on sober argumentation. Lote hits dry, direct, hard. Also he traces the evil much farther back than Benda, farther back than even Edgar Quinet had done; further back than Treitschke, further back even than Fichte. In Lote's opinion one must go back to the eighteenth century: Elizabeth of Russia was merely using flattery towards the Frenchmen of the age of Rationalism, and made them only believe that all Europe was in admiration before the clever geniuses of France; the same is true of Frederick the Great and his so-called protection of Frenchmen of letters exiled from France because of their advanced ideas (Voltaire, Diderot, etc.). Those bourgeois monarchs really got the best of French vanity, and by astutely flattering them rendered them harmless. There are some remarkably suggestive pages; for instance, when Lote points out "the idyllic *bonhomie* of the old Gessner," preparing the sentimental Germany which could be used later to conceal, provisionally, from the outside world the lusty beast of Belgian invasion; or the pages on the "austere criticism" of Lessing, which was meant to ruin the prestige which French classical literature had enjoyed in Germany; or again when Lote points out especially Goethe, who has

been "worked with great skill,"—the "European" Goethe, who was presented to France to prove that in the eyes of Germany there was but one Europe; the "Olympian" Goethe, representing a civilization where one lives above the low and human aims of domination and conquest; or again the "Bourgeois" Goethe, poet of Hermann and Dorothea, who would serve so well to deceive the French with the good-heartedness of Goethe, . . . Goethe plays a symbolic part in the "illusions" of the French people, and has contributed more than any other to make them "heedless (étourdis) apostles of mediocre Germany:" Let, therefore, France stop falling on her knees before the "romanesque adventure of the alchemist Faust."

Elsewhere Lote sees, behind the constant study of Romance philology by German scholars, a distinctly unfriendly purpose; namely, they wish to undermine the national feeling, in showing, in French literature and in the various dialects of the country, the trace of entirely different races, which have just *accidentally* been united under one political rule. Here they were Celts, there Wallons, there Provencaus. . . . In dismembering France politically, one would just do the natural thing.

What about philosophy and metaphysics? Nobody was more pleased, of course, than German leaders to see French scholars advocating an impassive and disinterested science on the one hand, and on the other, absorbing themselves in aimless erudition. In the meanwhile, German science simply identified its purposes with those of imperialistic Pan-Germanism. They used their science and their brains to perfect Krupp works while French philosophers outdid Kant and old-time German philosophers in metaphysical acrobatics; while they taught Treitschke and Bernardi to their students, the French besieged the chair of the intuitionistic metaphysician Bergson: Bergson again has to bear the burden of reproach.

There are two imperialisms threatening the world: *Pan-Germanism*, wishing to reign by might of arms, and the gentle, evangelical if you please, imperialism of *Utopian Socialism*, ending in anarchy. Which of the two will win? Let us hope neither, but that the world will belong to science. "Cruel, but necessary science of struggling and of conquering;" for, if things come out this way, there will be again a chance for the spirit that inspired the classic civilization of France, a civilization based on rational and humane principles. As

soon as clear thinking and keenness of intellect are restored, France's days will have returned.

* * * * * * * *

Before ending let us add that the warning against not only the blind admiration for German writers, but against the adoption of the so-called German methods in French universities had started before the war. The stir created in 1911 by Agathon's (Tarde et Massis) *L'Esprit de la Nouvelle Sorbonne* has been often recalled recently; and if the denunciations have become more violent since the war, there have also been some people who thought that tabooing excessive; they could give as an argument the disagreement that existed as to which German authors were particularly objectionable. E. g., many agreed that Nietzsche's following in France has been nefarious, while others declare that Nietzsche has been misunderstood and, moreover, that he was as much a despiser of Germany as any writer since his time. There is quite a literature on that subject. While Claudel, Lote, and Benda exorcize Nietzsche, Goethe and Kant, not to speak of Luther "who is with the Devil" (Claudel), Henri Bois, in *Kant et l'Allemagne,* frees Kant of the accusation of being a precursor of Pan-Germanism and the "inspirer of the military philosophy invoked by Germans to justify their misdeeds," and Alphonse Aulard, in *La Paix Future d'après la Révolution Française et Kant,* recalls the plan for universal peace laid out by Kant. Lasserre, in a special little book on *Le Germanisme et l'Esprit Humain,* condemns Kant, Schelling, and Fichte, but recommends Goethe, Heine, and Nietzsche. While C. Bonnet, *l'Ame du Soldat* (chap. III), in his meekness, welcomes them all—he is almost Romain-Rollandist.

THE DISCRIMINATION OF CUTANEOUS PATTERNS BELOW THE TWO-POINT LIMEN[1]

By Cora L. Friedline

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I. Introduction

It has long been known that stimulation of the skin by a subliminal separation of compass-points is not by any means necessarily perceived as punctiform pressure. Kottenkampf and Ullrich,[2] for instance, speak of "the impression that the skin is being touched by an elongated body." Camerer[3] distinguishes four kinds of perception. Henri and Tawney,[4] Tawney,[5] and Judd[6] have found a variety of impressions

[1] From the Psychological Laboratory of Cornell University.

[2] R. Kottenkampf and H. Ullrich. Versuche ueber den Raumsinn der Haut der obern Extremität, *Zeit. f. Biol.*, VI, 1870, 42.

[3] W. Camerer. Versuche ueber den Raumsinn der Haut nach der Methode der richtigen und falschen Fälle, *Zeit. f. Biol.*, XIX, 1883, 282.

[4] V. Henri and G. Tawney. Ueber die Trugwahrnehmung zweier Punkte bei der Berührung eines Punktes der Haut, *Philos. Studien*, XI, 1895, 394 ff.

[5] G. Tawney. The Perception of Two Points not the Space-threshold, *Psych. Rev.*, II, 1895, 585 ff.

[6] C. H. Judd. Ueber Wahrnehmungen im Gebiete des Tastsinnes, *Philos. Studien*, XII, 1896, 409 ff.

ranging from one point to a line between boundaries. Leuba[7] noticed that "the passage from oneness to twoness is through a sensation of length." Bolton[8] mentions intermediate forms which lie between one and two points. Binet[9] obtained a special perceptive form within the limits of one and two points. Foucault[10] distinguishes no less than six intermediate perceptive forms. Gates,[11] working in the Cornell laboratory in 1915 by a strict psychophysical procedure, was able to assign quantitative values to such patterns as circle, line and dumb-bell, which lay between the extremes of one and two points.

The whole question of these cutaneous patterns was set in a new light when Titchener[12] in 1916 showed that, if no effort is made to rule out the stimulus-error, discrimination may be carried to a very high degree of delicacy. Titchener used his results to explain the discrepancy found by McDougall[13] in the cutaneous perceptivity of Englishmen and Torres Straits Islanders. An extension of this work by de Laski[14] seemed to show that further systematic investigation might make it possible to reconcile, in like manner, some of the outstanding controversies concerning the aesthesiometric experiment.

The present paper is a report of such an investigation. We have sought to determine the limits of discrimination of two-point impressions, when the subjects[15] are left entirely free to objectify them, to take them as cutaneous 'things' or 'objects,' in other words, to take up towards them the attitude of everyday life rather than that of descriptive psychology. We shall first state what our subjects have been able to do, and shall then try to show that shifts from the everyday to the psychological attitude will account for differences of

[7] J. H. Leuba. On the Validity of the Griesbach Method of Determining Fatigue, *Psych. Rev.*, VI, 1899, 576.

[8] T. L. Bolton. Ueber die Beziehungen zwischen Ermüdung, Raumsinn der Haut und Muskelleistung, *Psychol. Arbeiten*, IV, 1902, 192.

[9] A. Binet. La mesure de la sensibilité, *L'année psych.*, IX, 1903, 79 ff. Cf. J. F. Messenger, *Harvard Psych. Studies*, I, 1903, 130.

[10] M. Foucault. L'illusion paradoxale et le seuil de Weber, 1910, 124 ff.

[11] E. J. Gates. The Determinations of the Limens of Single and Dual Impression by the Method of Constant Stimuli, *Amer. Journ. Psych.*, XXVI, 1915, 152 ff.

[12] E. B. Titchener, in *Proc. Amer. Philos. Soc.*, LV, 1916, 569 ff.

[13] See *Reports of the Cambridge Anthropological Expedition to Torres Straits*, II, 1901, v. f., 1 ff.

[14] E. de Laski. On Perceptive Forms below the Level of the Two-point Limen, *Amer. Journ. Psych.*, XXVII, 1916, 569 ff.

[15] We use the term *subjects* rather than *observers*, since we made no demand for psychological observation and descriptive reports.

numerical results that have hitherto been ascribed vaguely to practice and fatigue.

II. Experimental

1. *Apparatus.* The apparatus consisted of a modification of the improved Jastrow aesthesiometer. We modified this instrument[16] by supporting it from the handle by means of a compression spring. This spring was placed about the stem of the aesthesiometer as an axis, between a stop at the upper end of the stem and the top of the handle, to which it was attached. The aesthesiometer can thus be lifted by the handle, with its weight compressing the spring. If the points are now brought into apposition with the skin and the handle is lowered from the stem, the weight of the instrument, as the spring extends, will gradually be transferred from the handle to the skin. The rate of depression of the handle, after the points have come upon the skin, determines the rate of application of the pressure; and the amount of depression, the amount of the pressure. (Since the instrument can be weighted and various springs used, any desired pressure can be obtained.) We found it convenient to encase the spring in an aluminum tube, which was attached to the handle and fitted over the stop at the upper end of the stem. This tube kept the spring in place, steadied the handle (since it fitted accurately over the stop), and would be more convenient to grasp, in manipulating the aesthesiometer, than the handle itself. In our case, however, a constant application of stimulus was obtained by means of the mechanical device described by Dimmick.[17] The amount of pressure employed was 15 grams $\pm$ .5 mg. (25 trials, measured on a chemical balance). The arm of the subject was placed in a plaster cast, and the apparatus was supported over the arm in such fashion that it could be moved in both directions in the horizontal plane. A silent pendulum was used for controlling the warning signals and the length of the stimulations.

2. *The Subjects.* The subjects were Mr. L. B. Hoisington (H), instructor in education, practised; Mr. F. L. Dimmick (D), assistant in psychology, highly practised in cutaneous observation; Miss J. M. Gleason (G), graduate fellow in psychology, well practised; Mr. P. T. Young (Y), graduate scholar in psychology; and Mr. G. J. Rich (R), graduate student in psychology. The last-named took part only in the preliminary work.

[16] The aesthesiometer will be described in detail later.

[17] F. L. Dimmick. On Cutaneous After-Images, *Amer. Journ. Psych.*, XXVII, 1916, 566.

3. *Determination of Pressure Intensity.* We have said that the pressure employed was that of 15 gr. This intensity of stimulus was chosen after we had made, in preliminary experiments, a comparison of the pattern-names obtained for the same stimuli at different intensities. The method of procedure was as follows.

The stimulus-differences 15 mm. and two-points-apposed were used. Each of these stimuli was given 9 times with a pressure of 10 gr. After every application the subject was asked to describe the pattern, and then to give a general characterization of the impression at the end of the ninth application. The same method was followed with pressures of 20 and 15 gr., respectively. Results showed that approximately the same patterns were obtained for the corresponding stimuli at the different pressure-intensities.

For instance, in 35 trials with 15 mm. separation, G reports dumb-bell (12) [18], two points (13), double paddle (10), with the intensity 10 gr.; dumb-bell (8), two points (12), and double paddle (15), with 20 gr.; dumb-bell (17), two points (13), double paddle (5), with 15 gr. D reports, for the same separation, two points (10), dumb-bell (12), long line (13), for pressure of 10 gr.; two points (15), dumb-bell (20), with 20 gr.; and two points (23), dumb-bell (12), with 15 gr. Similarly, R obtains line (22), dumb-bell (13), with pressure of 10 gr.; line (28), dumb-bell (7), with 20 gr.; and line (21), dumb-bell (14), with 15 gr. With two-points-apposed, in 35 trials, G reports line (12), short straight line (5), small dumb-bell (18), for 10 gr. pressure; line (22), short line (13), with 20 gr; line (25), short line (10), with 15 gr. D obtains one point, and R spot, in all 35 trials for every intensity of pressure, with two-points-apposed.

The middle pressure of 15 grams was selected as that to be employed throughout the investigation.

4. *Pressure Spots.* Another preliminary problem was that of determining whether it was necessary to avoid the stimulation of highly responsive pressure spots in applying the points. In other words, our aim was to find out whether the patterns obtained with the stimulation of highly responsive pressure spots differed from those which occurred when less responsive pressure spots or intermediate cutaneous areas were stimulated. The most responsive pressure spots within the area of stimulation were accordingly localized (in 15 trials), and marked by means of indelible ink. The stimulus employed for localization was a horse-hair of 0.105 mm. in diameter. This was fitted into an aesthesiometer tube, and adjusted to present a length of 38 mm., its stimulation value being 2.4 g/mm. (von Frey's tension units). The separations used in the work were 15 mm. and two-points-apposed.

First, 9 applications of the stimulus corresponding to the separation 15 mm. were given. Care was taken to stimulate a different intensive pressure spot every time. (Obviously, only one pressure spot could be stimulated in a given application, since the distance apart of the pressure spots did not necessarily correspond to the separation distance 15 mm.). The subjects were told to notice how the stimuli were alike, with a view to reporting a common pattern-name at the end of the ninth application. In a similar manner, 9 applications corresponding to the stimulus two-points-apposed were given, with the request for a report of a common pattern-name at the end of the ninth application. The above method of procedure was also used for the determination of pattern-names where the intensive pressure spots were

[18] Numbers in brackets indicate the number of times the pattern is reported.

avoided in the application of the points. The results showed that the stimulation of intensive pressure spots made no significant difference in the patterns obtained for the two separations.

In 50 trials (450 applications) with 15 mm. separation, G reports, with highly responsive pressure spots: double paddle (19), dumb-bell (31); without highly responsive pressure spots, double paddle (10), dumb-bell (26), two points (14). Similarly D reports: with highly responsive pressure spots, long line (41), two points (9); without highly responsive pressure spots, line (43), two points (7). In 30 trials, R reports: line (18), dumb-bell (12), with highly responsive pressure spots; and line (23), dumb-bell (7), without highly responsive pressure spots.

For two-points-apposed, with pressure spots, in 50 trials G reports: line (27), short, straight line (12), short dumb-bell (11); and line (28), short straight line (22), without responsive pressure spots. Similarly, D obtains one point for all 50 trials, both with and without the stimulation of highly responsive pressure spots. In 30 trials, R reports, with highly responsive pressure spots, spot (10), circle (20); and spot (30), with avoidance of such pressure spots.

We further tried to find out whether the stimulation of the highly responsive pressure spots as compared with the stimulation of the less responsive areas made a difference in the percentage of accuracy in the haphazard series. The method was much the same as that described above. The subject was given 9 practice applications of the separation 15 mm. and was asked to characterize the impression at the end of the ninth application, and also to memorize it with a view to identifying it later in a haphazard series. In a similar manner, he was given the stimulus of two-points-apposed. This was followed by a haphazard series of 10 applications, composed of 5 applications of each stimulus employed in the practice series. The subject was asked to judge which one he was receiving, as immediately as possible after it was applied. The procedure was followed, first, with the stimulation of the most responsive pressure spots, and secondly, with avoidance of these spots.

Although the investigation was not extensive, the results were definite enough to warrant the conclusion that the stimulation of the highly responsive pressure spots as compared with that of other areas made no significant difference in the percentage of accuracy obtained in the haphazard series.

In 4 haphazard series, with the stimulation of highly responsive pressure spots, G obtained an average of 80% accuracy, and on other areas also 80%, for stimulation with the separation 15 mm. For two-points-apposed, the same subject obtained 90% both with the stimulation of the highly responsive pressure spots and with that of other areas.

In 3 haphazard series, D obtained 100% with highly responsive pressure spots, and 93% with the less responsive areas, for the 15 mm. stimulation. For two-points-apposed D obtained 87% in both cases.

5. *Method: Haphazard Arrangement of Series.*

Eleven separations below the two-point limen were used:[19] app., 2, 5, 7, 10, 12, 15, 17, 20, 22, and 25 mm. They were

[19] The limens for D and G were accurately determined as 30 ± 0.8 and 32 ± 2.0 mm. respectively. Those for F and Y were less accurately determined as 29 and 33 mm.

arranged in pairs in all the mathematical combinations possible, and these pairs were drawn at haphazard during the course of the investigation, thus determining the order of the 55 experiments as follows:

1. app–15	15. 5–12	29. 5–15	43. 7–15
2. 10–20	16. 7–22	30. app–10	44. 15–17
3. 5–25	17. 17–22	31. 15–22	45. 12–20
4. 7–12	18. app– 2	32. 10–25	46. app– 5
5. app–17	19. 2– 7	33. 7–10	47. app–12
6. 10—17	20. app–22	34. 2–22	48. 5–22
7. 5–20	21. 7–17	35. 5–10	49. 17–20
8. 20–22	22. 2–17	36. 10–22	50. 2–15
9. 2–12	23. 12–25	37. 15–25	51. 2–25
10. 2– 5	24. 20–25	38. 5–17	52. 7–25
11. 15–20	25. 5– 7	39. 22–25	53. 17–25
12. 12–22	26. app–25	40. 12–17	54. 2–20
13. 7–20	27. 12–15	41. app–20	55. 2–10
14. app– 7	28. 10–12	42. 10–15	

Every experiment consisted of 10 haphazard series, each one made up of 10 applications, 5 of the stimulus corresponding to the first, and 5 of the stimulus corresponding to the second separation of the pair employed. There were, therefore, 100 applications in a single experiment. The order of application of the stimuli, within every series of 10, was determined separately for that series by the drawing of lots. The investigation as a whole, then, consisted of 100 observations upon every one of the 55 possible pairs of separations, or of 5500 observations for a single subject.

6. *The instructions.* Our first instruction was as follows:

"You will be given in a practice-series two cutaneous stimuli which I shall name 'A' and 'B' respectively. After four presentations of each, given in the order, A, B; B, A; A, B; B, A; with their names, I shall give you a series in which the stimuli A and B occur in haphazard order.

"You are to judge each impression as A or B, or you may report, 'I can't tell.' You may, however, use any other names which seem more appropriate or convenient to distinguish the two impressions.

"Make your judgment as quickly as possible. The stimulus will not be removed from your arm until you have made your judgment.

"Any observations or remarks that you care to make may be dictated to the experimenter at the end of the series."

This instruction, however, proved unsatisfactory. It became evident that if a stimulus A were paired in a given haphazard series with a certain B, A might always be recognized: whereas, if the same A were paired with a certain other B, it might never be recognized. This result seemed to indicate that

judgments were made in terms of A and not-A, or B and not-B, rather than in terms of A and B.[20]

Accordingly the instructions were changed to the following:

"In a practice-series I shall apply to your arm two cutaneous stimuli which I shall call 'A' and 'B.' I shall apply each stimulus twice, giving its name each time. You are to identify and to memorize the two impressions.

"I shall then give you a series in which the stimuli A and B occur in haphazard order. You are to judge the impressions as A or B, or you may say 'I can't tell.' You may, however, use any other name (*e. g.*, a descriptive term) that helps you to identify the impressions. Make your judgment as quickly as possible.

"Any observations or remarks that you care to make may be dictated to the experimenter at the end of the series."

The subjects still had difficulty in identifying the two impressions. In addition, they complained that the length of the practice-series was too short to permit them to memorize the patterns. The instruction was, therefore, altered to read as follows:

"You will be given nine[21] cutaneous stimuli that are just alike. Notice how these are alike all the way through with a view of reporting a common pattern-name at the end of the ninth. Be sure to look for likenesses. I shall ask for a report of pattern at the end of the ninth."

This instruction preceded the giving of the practice series. In the early part of the investigation the subject was instructed as follows before every haphazard series:

"You will now be given a haphazard series composed of the two stimuli which you have just received. I shall ask you to judge which one you are receiving each time. You may use any terms you like to designate the two stimuli."

As the subjects became practised, the instruction preceding the practice-series was shortened to "Nine of each," "Three of each," or was not given at all, while that employed with the haphazards became unnecessary and was consequently omitted.[22]

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[20] Our attention was called to this error by the fact that an impression which was apparently identified in one series might fail altogether of identification in another series. For instance, in the case of app-5, 5 mm. apparently was always recognized, whereas in the case of 5-10, this same 5 mm. was never recognized. Another indication was the fact that, in the haphazard series proper, there were as many different patterns for the 5 mm. stimulus as there were applications of that stimulus.

[21] This number was found convenient for covering the cutaneous area, since it permitted a uniform variation of the position of the points.

[22] The observation periods were one hour in length. At first, only 3 haphazards were given during the hour, but as the subjects became

The results which are the subject of discussion of this paper were obtained entirely under the final instruction.

7. *General Practice.* A certain amount of preliminary practice work was necessary in order to accustom the subjects to the conditions of the experiment. Among the initial difficulties we have already mentioned that of interpreting the instructions. During this period the judgments in the haphazards ranged from 50 to 80% in accuracy, whereas in the later series with maximal practice the judgments, as will be seen, ranged from 80 to 100%. G required 16 haphazard series, extending over a period of 5 hours, for practice. D required 10 haphazards, extending over a period of 3 hours; Y, 39 haphazards, covering a period of 13 hours; while H was able to make accurate judgments almost from the beginning.

8. *Experimental procedure.* The observation periods of one hour each occurred three times a week. The experiments were performed as often as possible in the early morning hours when the subject was free from fatigue.

The work was done on the volar distal right fore-arm in an approximately longitudinal direction. An area 40 mm. long by 10 mm. wide was marked off with ink in a place relatively free from veins and tendons. Topographical features of the skin ensured constancy in the marking of this area. The position of the points was varied as much as possible within the area in order to avoid fatigue of the skin.

We have said that a plaster cast was made for the arm of every subject. This kept the arm in the same position, and rendered it immovable throughout the course of the experiment. At first, the arm was taken out to rest during the interval between the practice and the haphazard series, as well as between the separate haphazard series. These rests were later omitted, however, as the subjects became practised.

The subject was comfortably seated at a table with his arm in the cast, which was excluded from his view by means of a cardboard screen. The experimenter gave the usual Ready-Now signals and applied the stimulus corresponding to the first member of the practice series. The stimulus was kept on the arm for a period of two seconds, the interval elapsing be-

practised, this number was gradually increased, until in particular instances it was possible to run off as many as 40 haphazards during the course of a single hour. In the early part of the work, 18 practice applications were given before every haphazard series of 10, *i. e.*, 9 of each stimulus of the pair. Later the practice series were lessened to 6, *i. e.*, 3 of each stimulus composing the pair. Finally, in the case where 40 haphazards were reached, it was necessary to give the practice series only once, namely, at the beginning of the experimental hour. This was possible only where the subjects obtained 100% accuracy, since the presence of an incorrect judgment in the haphazard series always necessitated the giving of a practice series before the next haphazard.

tween the separate stimulations being one and one-half seconds. This interval was later decreased to one second. At the end of the ninth application, the general pattern name was recorded. Similarly, a second practice series of nine was given. These were followed by a haphazard series. The length of application of the stimuli here was the same as that in the practice series.

The judgments in the haphazard series were usually made in terms of the pattern names given in the preliminary series. As a rule, they were made as immediately as possible after the application of the stimulus. Upon the completion of 10 haphazards, a new experiment was announced.

9. *Results.* Table I gives a summary of the results of the entire experiment. The numbers represent the percentages of correct judgments in the case of each member of a pair of stimuli. They are based on the averages of 10 haphazard series, *i. e.*, 100 judgments (50 on each stimulus), obtained at maximal practice.

The lower values in this table might very well have been raised to 100-100, with more results taken. The lower num-

TABLE I

Number of Experiment	Separations in mm.	D	G	Y	H
18	app- 2[23]	—— [24]	86- 92	——	——
46	app- 5	100-100	92- 92	94- 94	94- 86
14	app- 7	100-100	94- 90	96- 88	86- 86
30	app-10	100-100	96- 98	90- 92	98- 92
47	app-12	100-100	96- 94	86- 92	92- 86
1	app-15	100-100	100-100	94- 92	96- 94
5	app-17	96-100	98-100	94- 96	98- 96
41	app-20	100-100	100-100	86- 98	98- 94
20	app-22	100-100	100-100	84- 96	100- 92
26	app-25	100-100	100-100	86- 96	100- 92
10	2- 5	——	86- 94	——	——
19	2- 7	100-100	86- 90	88- 94	92- 96
55	2-10	100-100	100-100	92- 98	94- 90
9	2-12	100-100	92- 98	94- 94	94- 98
50	2-15	100-100	100-100	84- 88	98- 94
22	2-17	100-100	100-100	88- 92	88- 84
54	2-20	100-100	100-100	88- 96	98- 94
34	2-22	100-100	100-100	90- 92	98- 92
51	2-25	100-100	100-100	90- 98	100- 94

[23] Typical of the patterns reported are line, short line, dumbbell, double paddle, single paddle, oval, circle, oblong, rectangle and bar.
[24] The failure of an experiment is indicated by a dash.

TABLE I (Continued)

Number of Experiment	Separation in mm.	D	G	Y	H
25	5– 7	——	——	——	——
35	5–10	100–100	96– 94	98– 96	86– 86
15	5–12	100–100	100–100	96– 94	90– 86
29	5–15	100–100	94– 92	80– 94	90– 94
38	5–17	100–100	98– 94	94– 98	88– 94
7	5–20	98–100	100–100	86– 92	94– 88
48	5–22	100–100	100–100	84– 98	100– 88
3	5–25	100–100	100–100	98– 96	96– 90
33	7–10	96–100	92– 94	——	——
4	7–12	100–100	100–100	90– 98	88– 88
43	7–15	98–100	100– 96	84– 96	88– 94
21	7–17	100–100	96– 94	82– 92	96– 96
13	7–20	100–100	100–100	86– 88	96– 88
16	7–22	100–100	100–100	84– 94	98– 94
52	7–25	100–100	100–100	82– 94	98–100
28	10–12	——	——	——	——
42	10–15	100–100	96– 94	92– 94	90– 94
6	10–17	96– 94	92– 94	96– 98	86– 90
2	10–20	100–100	100–100	96– 88	98– 86
36	10–22	100–100	98– 96	98–100	94– 90
32	10–25	100–100	98–100	96– 98	92– 96
27	12–15	——	——	——	——
40	12–17	100–100	94– 90	92– 98	96– 96
45	12–20	100–100	100–100	88– 96	96– 96
12	12–22	100–100	98–100	90– 96	92– 94
23	12–25	100–100	100–100	94– 96	96– 84
44	15–17	——	——	——	——
11	15–20	100–100	94– 98	94– 92	98– 92
31	15–22	100–100	94– 98	98– 96	96– 92
37	15–25	100–100	98– 98	96– 96	88– 90
49	17–20	——	94– 98	——	——
17	17–22	100–100	94– 98	94– 98	94– 90
53	17–25	100–100	100–100	90 –98	92– 88
8	20–22	——	——	——	——
24	20–25	100–100	90– 92	94– 98	94– 96
39	22–25	——	94–100	94– 98	——

bers mean, in the majority of cases at any rate, some temporary disability.

10. *Discussion of results.* From a study of the table it is evident that the subjects either were able to distinguish be-

tween the separations with a considerable degree of accuracy, or were not able to make any distinction at all between the separations given them. The latter result is found, however, only in the case of separations which were very near together.

Table II gives the experiments which were declared by the subjects to be especially difficult. Where the experiment failed, that result is indicated by a dash. Difficulty is indicated by "X." Absence of mark means that the experiment was not difficult for that particular subject.

In the case of D and G, the distinction is clear-cut, while in the case of Y and H there is variation. If some subjective difficulty arises, it is, of course, possible for *any* pair to be regarded as difficult, no matter how wide the separation of the points.

In the case of the more difficult experiments we found that it was possible to take only two haphazard series at a time; after these, the subject was likely to break down completely.

TABLE II

TABLE OF DIFFICULTIES

Number of Experiment	Separations in mm.	D	G	Y	H
18	app– 2	—	X	—	—
46	app– 5	X	X	X	X
14	app– 7		X		
10	2– 5	—	X	—	—
55	2–10		X		X
25	5– 7	—	—	—	—
35	5–10	X	X	X	X
15	5–12			X	X
33	7–10	X	X	—	—
4	7–12	X		X	X
28	10–12	—	—	—	—
42	10–15			X	X
6	10–17	X	X	X	X
27	12–15	—	—	—	—
44	15–17	—	—	—	—
49	17–20	—	X	—	—
8	20–22	—	—	—	—
24	20–25	X	X	X	X
39	22–25	—	X	X	—

11. *Conditions which Derange the Experiment.* Throughout the course of the investigation certain factors were noticed which proved fatal to the securing of any results. When

these influences were operative, it became impossible for the subject, despite his best efforts, to identify the patterns presented to him in the haphazard series. This means that there was no series of graded judgments in the haphazard series, when these conditions occurred, since the percentage of accuracy dropped straightway from 100-80 to 20-0 and 40-0, leaving not even the possibility of a chance distribution of judgments. In other words, the haphazard series could not even be termed a 'bad' one, but was rather a complete failure. Furthermore, in the presence of these factors, the subjects were frequently unable to give a general characterization of the impression at the end of the ninth application of the practice series, so varied were the separate impressions. Under these conditions stimuli as widely separated as 25 mm. and 5 mm. were reported as giving the same pattern. Subjects also mention variations in the sensitivity of the area, and in the intensity, size, clearness and brightness of the impressions themselves.

A discussion of these factors and their influence upon the results follows.

Fatigue. D was particularly liable to fatigue. For instance,[25] at 5 p. m. 11/13/17, app-17, D's results were 40-20 (Av. 2), but at 10 a. m. 11/16/17, his results are 96-100 (Av. 6), for the same stimulus pair. Similarly at 5 p. m. 10/17/17, app-15, his results are 40-0 (Av. 2), but at 8 a. m. 10/20/17, they are 100-100 (Av. 5).

H was also affected by fatigue caused by staying up all night. At 10 a. m. 1/27/18, app-15, results are 20-0 (Av. 3), but on 1/30/18, at the same hour, they were 80-84 (Av. 5). In connection with the first series he remarks: "I can't feel the thing at all; the patterns are just the same—points." H also reports that, when he is fatigued, waves of numbness sweep over the arm from the finger tips to the elbow, preventing the obtaining of results, except for one or two series at the beginning of the hour.

Fatigue in G is also accompanied by numbness in the arm, which prevents the obtaining of patterns. For example, at 8 a. m. 1/4/18, 12-25, G obtains such results as 20-40 (Av. 3) in the haphazard series, but at 8 a. m. 1/8/18, she obtains 100-100 (Av. 5) for the same stimuli. G, however, was seldom troubled by fatigue.

Y experienced a general state of fatigue during a period of several days, which prevented the securing of any results, no matter what stimuli were employed. This period extended from 12/7/17 to 1/28/18, during which time Y was unable to give any results when the following stimuli were employed: 15-20, 12-22, 7-20, app-7, 5-12, 7-22, and app-25. Y remarks: "The period in which I did nothing was a period of general fatigue. I am just coming out of this state of

[25] A convenient formula will be used for the expression of the results given here: 1. Time of day; 2. Date; 3. Stimuli employed; 4. Results of haphazards in average percent; 5. Number of haphazards from which the average is obtained. (Ex: with stimuli app-15, 20-0 means 20% accuracy for apposed and 0% for 15.)

fatigue." [This was reported at 10 a. m. 2/1/18, when his results with app-22 are 80-100 (Av. 2)].

At 10 a. m. 2/2/18, in connection with the same experiment, Y obtains such results as 20-0 (Av. 2) and reports fatigue from being up late the night before. He remarks: "Yesterday the impressions were as clear as ice, now they tend to confusion. There is a change in the experiences themselves as they are given. There is a tendency for the points to turn and be at an angle to the axis of the arm. This is especially true of the smaller patterns. There is also a tendency for three points to come in. I have noticed that this usually means that I am no good at all. The impressions themselves are of low intensity and weak; the distance between the points varies, in the larger pattern. Sometimes the points are bright, other times they are dull, round, and more spread out. There is also a tendency for them to roll off my arm."

At 9 a. m. 2/27/18, with 2-17, results are 40-20 (Av. 4), and Y remarks: "The patterns become smaller and smaller when I fatigue out on them."

General Physical Condition. Both H and Y are unable to work when affected by cold or grippe. H at 10 a. m. 12/29/17, 10-17, obtains 20-0 (Av. 4). He remarks: "My arm is insensitive, there are waves of numbness." But on 1/8/17, at the same hour, he has no difficulty in getting 80-100 (Av. 3).

At 10 a. m. 1/9/18, H reports indigestion, and this throws off the results on 10-17 again, to 0-40 (Av. 3).

Y reports a cold, and consequently obtains no results in the following experiment. At 12 a. m. 11/23/17, app-17, he gives 20-20 (Av. 3), whereas results on 11/23/17, were 80-100 (Av. 3).

After-Images. A source of error inherent in the procedure itself was the arousal of cutaneous after-images. G was particularly subject to these images. They were especially troublesome where the separations were close together, and made it impossible to run more than one or two such haphazards in the course of an hour. Their occurrence also made it impossible to take more than three experiments in a single hour, as a rapid succession of stimulations was always accompanied by numerous after-images. When after-images appeared, the experimenter wiped the area gently with a soft cloth. This corrective was usually successful.

Towards the end of an experimental hour H frequently complains that all sorts of other impressions creep in, in nature like after-images. For instance, at 4 p. m. 2/14/18, 2-25, results are 0-20 (Av. 3) towards the end of the hour, but on the following day at the beginning of the hour the same stimuli give results 100-100 (Av. 5).

Emotional State. The emotional state of the subject frequently prevented the obtaining of any results.

D at 10 a. m. 11/20/17, app-17, 40-20 (Av. 4), says: "I hate the experiment—I am mad at the thing. I do not know what I am looking for. The thing is nerve-racking; you expect me to do well and yet you put everything in the way you can." But at the same hour on 11/21/17, with the same stimulus pair and no inhibiting emotional state, he obtains 100-100 (Av. 4). Again at 10 a. m. 12/13/17, 15-20, 40-0 (Av. 3), he says: "The emotional side makes a lot of difference. Every little thing you do bothers me—the making of the report, the putting down of the pencil, etc."

The giving of a difficult series at the beginning of the hour usually

annoyed D to such an extent, and upset him so much emotionally, that no results could be obtained during the remainder of the hour. For instance, the giving of 15-17, on 1/27/18 at 10 a. m., threw off the results in 12-20 to 40-0 (Av. 4).

Y frequently reports a variable mood, which is accompanied by variations in the experiences, as to distance apart, number, size and brightness. At 12 a. m. 12/5/17, 5-20, Y obtains 20-0 (Av. 3), when in a variable mood. Again, at 10 a. m. 1/30/18, 2-20, Y's results are 0-40 (Av. 4), and he reports: "I do not feel in the mood, I am nervous. I do not want to quiet down to this." But on the following day with the same experiment, at the same hour, his results are 100-100 (Av. 3), when he is in an even frame of mind.

Suggestion. The element of suggestion entered in with especial force when the memory of a difficult series carried over from one experimental hour to the next. At 10 a. m. 1/17/18, 22-25, in the case of D, gives no results. On the followwing day, D remarks that the first experiment is going to be difficult. Moreover, the slightest suggestion on the part of the experimenter was sufficient to influence the results. For example, at 8 a. m. 11/17/17, 10-17, G asks if the patterns which she is about to receive are difficult. The experimenter incautiously replied that the experiment might possibly be difficult, but that it had not yet been tried. This resulted in 0-40 (Av. 2). But on 11/19/17, at the same hour, the experiment gave 100-100 (Av. 3), with no difficulty at all.

Temperature of the Cast. It was necessary to keep the casts at a moderate temperature since extreme temperatures prevented the securing of results. For instance, G was unable to identify the patterns in the haphazard series when the cast was very warm. At 8 a. m. 12/27/17, 25-20, results were 33-33 (Av. 3), but under normal conditions on 12/28/17, results were 100-100 (Av. 2). Extreme cold had a similar effect. At 8 a. m. 1/7/18, 12-25, results were 20-0 (Av. 4), but are 100-100 (Av. 10), at the same time on the next day when the cast is at normal temperature.

At 2 p. m. 1/4/17, Y gets no pattern-differences for app-25, and consequently the haphazard is not given, but on the following day at 10 a. m. he obtains 86-96 (Av. 10), when the cast is at the usual temperature.

Noises. D was distracted by outside noises such as talking in an adjoining room, or the ringing of the chimes. At 5 p. m. 11/13/17, 7-12 the results are 40-40 (Av. 2), when D is disturbed by the ringing of the chimes, but are 100-100 (Av. 10) later, when the chimes have ceased to ring. Again, the results at 10 a. m. 10/23/17, for 10-20 are 60-50 (Av. 2) when there is conversation in the next room, but change to 80-100 (Av. 1) when the conversation has stopped.[26]

III. The Alleged Effect of Practice on the Two-point Limen

In the literature we find conflicting statements as to the influence of practice on the two-point limen. Some investigators

[26] Foucault (*op. cit.*, 180) finds that pain in the head and poor sleep render the perceptions uncertain. Noikow (see Note 41 below; 437 ff.) notices the disturbing effects of poor sleep, no breakfast, headache, cold, fever, being out late and being up all night.

assert that the limen can be greatly reduced by practice, and others hold that there is no such reduction.

The first experimental investigations in regard to the influence of practice on the limen were made by Volkmann and Fechner[27] in 1858. These investigators found a decided decrease in the limen with practice. For instance, the results of Volkmann show a reduction in the limen on the volar side of the left hand from 8 to 2 Paris lines (1 Paris line = 2.27 mm.), while the limen on the dorsal fore-arm decreased from 14.2 to 4.8. Similarly, the limen for Fechner's hand showed a decrease from 10.4 to 4.4, while that of the fore-arm changed from 14.9 to 7.5.

Dresslar,[28] in 1894, found that there is a decided increase in discriminative ability with practice. The value of the limen on the volar side of the left fore-arm, in a particular instance, decreased from 33 mm. to 2 mm. during the course of the morning, and from 26 mm. to 1 mm. in the afternoon.

Tawney[29] finds a decrease in the threshold value with practice in the case of some observers. In one case the threshold, on the left fore-arm, decreased from 50 mm. to 5mm. during the course of 20 days. Again, in the case of another observer, the threshold on the dorsal side of the right arm, above the elbow, showed a decrease from 55 mm. to 4 mm. But here there were frequently two thresholds present on the same day. For example, on a certain day the thresholds were 5 and 28, on the next day 7 and 30, then 8 and 30. Furthermore, when it was suggested to the observer that the influence of practice would be investigated, the value of the threshold decreased all the way from 14 mm. to 2 mm., while on the preceding day the values averaged 38 ± 4 (Av. 11).

In 1897, Solomons[30] found that the knowledge of the observer as to whether he was right or wrong had an influence upon the results. In the beginning of the experiment, both of his observers distinguished two points on the fore-arm at a distance of approximately one and one-half inches. However, after a few weeks' practice, the observer who had been informed as to the nature of his results distinguished two points at a distance of one-fourth inch, while the other observer still maintained the distance he had at the beginning of the experiment.

Foucault,[31] on the other hand, maintains that there is not any change in the threshold due to practice. His observer's threshold values are 12.75 mm., 11.25 mm., 12.18 mm., and 12 mm.

In order to explain the disagreement of these authors, we must take into consideration the fact that, with training, we attain a high degree of accuracy in the discrimination of 'objects' presented to us by the skin. Our own experiments

[27] A. W. Volkmann, Ueber den Einfluss der Uebung auf das Erkennen räumlicher Distanzen, *Ber. d. Sächs. Ges. d. Wiss.*, X, 1858, 38ff.

[28] F. B. Dresslar, Studies in the Psychology of Touch, *Amer. Journ. of Psychol.*, VI, 1894, 313 ff.

[29] G. A. Tawney, Ueber die Wahrnehmung zweier Punkte mittelst des Tastsinnes, mit Rücksicht auf die Frage der Uebung, *Philos. Stud.*, XIII, 1897, 163 ff.

[30] L. Solomons, Discrimination in Cutaneous Sensations, *Psych. Rev.*, IV, 1897, 246 ff.

[31] *Op. cit.*, 168 f.

show that, with training, distances as close together as 3 mm. can be discriminated without difficulty. This ability to distinguish between cutaneous objects may be used to account for the results of those authors who assert that there is a decrease in the limen with practice. For instance, the reduction of a limen from 40 mm. to 2 mm., in a particular case, may simply mean that the subject has changed his attitude in regard to the object which he was judging as the experiment progressed. In other words, the subject has been judging different objects, instead of the same object. He has, accordingly, reduced the size of the limen by changing his attitude in regard to the object judged. This reduction in the limen, due to a change of the object, has been wrongly called practice.

On the other hand, the results of those authors who affirm that there is no practice may be explained by the fact that the subjects have kept a constant attitude in regard to the object judged. Consequently, the limen has remained the same. Our own results indicate that there is no true practice-reduction except that which manifests itself in the initial stage. Practice, then, simply amounts to becoming acquainted with a particular object, so that we are able definitely to recognize it when it is presented; it means that we are getting the object, stably, at its lower limit. The 'reduction of the limen' depends upon other conditions.

IV. The Alleged Effect of Fatigue on the Two-point Limen

The results of previous investigators show a similar disagreement as regard the influence of fatigue upon the limen. There are those who declare that the aesthesiometer is a reliable measure of fatigue, as opposed to those who do not find such a condition.

Griesbach[32] was the first to observe that the limen is increased by fatigue. His subjects were pupils in the *Gymnasium* and in the *Oberrealschule*. Measurements were made at the end of every hour of school work during the course of the day. He finds an increase in the threshold on the forehead from 4 mm. to 11 mm., and on the red of the under lip from 7mm. to 19 mm. in the case of a 13-year-old pupil. Again, the threshold on the cheek increases from 11 mm. to 23 mm., and on the ball of the thumb from 6 mm. to 13.5 mm., in the case of a 16-year-old subject. Similarly, there is an increase in the threshold from 13 to 34 mm. on the cheek (front), during an examination day, for a pupil in the *Realschule*.

[32] H. Griesbach, Ueber Beziehungen zwischen geistiger Ermüdung und Empfindungsvermögen der Haut, *Arch. f. Hygiene*, XXIV, 1895, 124 ff.

Griesbach's[33] later measurements, made on members of the recruiting commission at Müllhausen, also show that fatigue causes an increase in the limen. In the case of the physician whose duty it was to examine the candidates the limen on the forehead measured 6.7 mm. at 8 o'clock in the morning, but after four hours' work increased to 15.5 mm. Similarly, the limen on the ball of the thumb (right) increased from 6.5 mm. to 8 mm.

The results of Wagner[34] and Vannod[35] agree with those of Griesbach. Wagner's results show an increase in the limen on the cheekbone from 11 mm. to 24 mm., from 5 mm. to 12 mm. and again from 3 mm. to 14 mm.

Vannod observes an increase in the limen on the forehead from 3 mm. to 12 mm., and from 4 to 16 mm. on the cheek, for a 16-year-old pupil in the *Realschule*.

Blazek,[36] in his experiments on the pupils in the *Franz-Joseph-Gymnasium*, found that the curves in several cases showed an increase in the limen with fatigue. Schuyten[37] also finds that the aesthesiometric method is satisfactory for measuring the fatigue of school children. Binet[38] concludes that it is possible to measure the intellectual fatigue of the school child by means of the aesthesiometer.

Sakaki,[39] who experimented in the schools of Japan, found an increase in the value of the limen with fatigue. His curves, which are based upon averages, show an increase in the limen during the course of the school day.

Bonoff,[40] a school physician, worked upon the pupils of the *Gymnasium* and found that the aesthesiometer can be used to measure fatigue. He found an increase in the limen on the cheek from 5.2 mm. to 11.38 mm. (average results for pupils during the course of examinations which lasted seven days). The limen on the cheek of 21 candidates for the baccalaureate examination increased from 7.7 mm. at 7:30 a. m. to 12.7 mm. at 1 p. m.

Noikow's [41] results indicate that the aesthesiometer is an index for the measure of fatigue. His measurements were made on the fore-

[33] H. Griesbach, Weitere Untersuchungen ueber Beziehungen zwischen geistiger Ermüdung und Hautsensibilität, *Internat'l Mag. of School Hygiene*, I, 1905, 414.

[34] L. Wagner, Unterricht und Ermüdungsmessungen an Schülern des neuen Gymnasiums in Darmstadt, *Samml. v. Abhandl. aus d. Gebiete d. päd. Psychol. u. Physiol.*, I, 1898, Hft., IV, 1 ff.

[35] T. Vannod, La fatigue intellectuelle et son influence sur la sensibilité cutanée, *Dissert. med. de Bern*, 1896, 1 ff.

[36] B. Blazek, Ermüdungsmessungen mit dem Federaesthesiometer an Schülern des Franz-Joseph-Gymnasiums in Lemberg, *Zeit. f. päd. Psychol, u. exp. Päd.*, I, 1899, 311 ff.

[37] M. C. Schuyten, Comment doit-on mesurer la fatigue des écoliers, *Archiv. de Psychol.*, IV, 1904, 113 ff.

[38] A. Binet, Recherches sur la fatigue intellectuelle scolaire et la mesure qui peut en être faite au moyen de l'esthésiomètre, *L'Année psychologique*, XI, 1905, 1 ff.

[39] Y. Sakaki, Ermüdungsmessungen in vier japanischen Schulen, *Internat'l Mag. of School Hygiene*, I, 1905, 86 f.

[40] N. Bonoff, Étude médico-pédagogique sur l'esthésiometrie et la simulation à l'école, *International Mag. of School Hygiene*, IV, 1907-8, 387 f.

[41] P. M. Noikow, Aesthesiometrische Ermüdungsmessungen, *Internat'l Mag. of School Hygiene*, IV, 1907-8, 437 ff.

head before and after fifteen minutes' work in arithmetic. In the case of one subject, the threshold increased from 5.3 mm. to 11.8 mm. For another subject, there was an increase from .2 mm. to 10.5 mm. Again, in the case of a girl in the elementary school, he finds an increase in the threshold from 1.9 mm. to 7 mm. after a lesson in reading. However, he finds that there is a lessening in the value of the threshold after very strenuous work. For example, in the case of one subject, the threshold on the forehead decreased from 8.5 mm. to 1mm. after a written examination, while that of another decreased from 12.4 mm. to 2.5 mm. after a two hours' examination. He attributes this decrease in the threshold-value to hyperaesthesia.

Offner[42] states that the relationship between fatigue and the spatial limen is sufficient to justify the use of the aesthesiometer as a measure of fatigue, more correctly as a measure for one of the symptoms of fatigue.

Foucault,[43] in his experiments upon two children, noticed that an excessive prolongation of the experiment resulted in an appreciable increase in the threshold. The first case is that of an eight-year-old girl, upon whom he made 12 successive determinations on the second phalanx of the dorsal side of the index-finger, with short intervals for resting. The threshold-values were as follows: 8 mm., an irregular series, then 8, 10, 8, 10, 8, 10, 12, 12, 12, 12. On the evening of the same day he obtained: 8, 12, 14, 14. The second case is that of a blind child, eleven years of age. The results were as follows: 12, 10, 10, 12, then 16, then an irregular series. He concludes that it is not surprising that the Griesbach method succeeds, in the light of the above results, provided, of course, that one is not too exacting on the quality of the measurement.

On the other hand, the validity of the Griesbach method for the determination of fatigue has been severely criticised and questioned. Leuba,[44] who experimented upon adults and college students, concludes that the aesthesiometric method is not to be regarded as a definite measure of fatigue, since many other factors must be taken into consideration, which are not capable of being measured. Germann,[45] whose results are based upon the tests of a single subject, was unable to find any relation between fatigue and the limen. Ritter,[46] in his experiments upon the students in the *Gymnasium*, did not find that the aesthesiometer could be used to measure fatigue. Bolton[47] concludes that the size of the threshold is not a measure of the effects of fatigue or mental work. His tables show that severe mental work, lasting for two hours, did not affect the threshold sufficiently to be detected by the aesthesiometer. Kraepelin[48] states that within very wide limits a

[42] M. Offner, Mental Fatigue, Eng. trans. Baltimore, 1911, 36 f.

[43] Op. cit., 181 ff.

[44] J. H. Leuba, On the Validity of the Griesbach Method of Determining Fatigue, *Psych. Rev.* VI, 1899, 573 ff.

[45] G. B. Germann, On the Invalidity of the Aesthesiometric Method as a Measure of Mental Fatigue, *Psych. Rev.*, VI, 599 ff.

[46] C. Ritter, Ermüdungsmessungen, *Zeits. f. Psychol.*, XXIV, 1900, 401 ff.

[47] T. L. Bolton, Ueber die Beziehungen zwischen Ermüdung, Raumsinn der Haut und Muskelleistung, *Psychol. Arbeiten*, IV, 1902, 175 ff.

[48] E. Kraepelin, Ueber Ermüdungsmessungen, *Arch. f. d. ges. Psychol.*, I, 1903, 9 ff.

definite relationship between size of threshold and degree of fatigue cannot be established.

Meumann[49] admits that the threshold is heightened by fatigue, but states that the increase is only very indirect and is complicated by many other factors, about which little is known. Whether the threshold increases in proportion to fatigue and permits of the use of the value which is found, as a real measure of fatigue, is a question which we cannot answer.

Martyn[50] concludes that changes in the spatial threshold are not sufficiently constant to be regarded as sure signs of fatigue in its early stages. Her results, however, do show just the kind of increase in the threshold which we should expect. For instance, the average of 10 thresholds taken before one hour's adding every day for 10 days was 7.65 mm., as compared with the threshold of 9 mm. which was taken after the adding, in the case of one subject. Again, the threshold for a second subject was 6.09 mm. before adding, but 6.87 mm. after adding, while that of a third subject increased from 7.30 mm. to 7.83 mm. These increases in the limen, according to our notion, were probably due to fatigue. The measurements cited above were made upon the left zygomatic arch.

It is clear from our own experiments that the initial determination of the two-point limen may mean very different things. If the experimenter happened to start with the two points clearly differentiated, fatigue will have a relatively small effect; but if the point of departure is some cutaneous pattern subliminal to two points, which nevertheless in a fresh condition can be distinguished from the pressure of a single point, then fatigue will, as our experiments show, make the identification of this pattern impossible and thus tend to raise the recorded limen.

It is evident, then, that if the limen which is initially determined is not the real two-point limen, it is impossible to keep a constant attitude when fatigue is present. For instance, the increase in the limen from 13 to 34 mm. on the cheek (Griesbach) may simply mean that the subject had for his initial limen some subliminal cutaneous pattern which, in a fresh condition, could be distinguished from the pressure of one point. With fatigue, the identification of this pattern became impossible. Consequently the subject was judging different 'objects' at the two stages of the test.

On the other hand, the results of those authors who assert that the limen does not increase with fatigue may be explained by the fact that the limen which was first determined was the real two-point limen, and not some subliminal cutaneous pattern which would be distinguished from the pressure of

[49] E. Meumann, Vorlesungen zur Einführung in die experimentelle Pädagogik und ihre psychologischen Grundlagen, II, 1907, 90 ff.

[50] G. W. Martyn, A Study of Mental Fatigue, *British Journ. of Psychol.*, V, 1913, 427 ff.

one point when the subject was in a fresh condition. Consequently, the limen remained approximately the same when the subject became fatigued. Our own results indicate that a constant attitude is possible only in cases where a real two-point limen has been determined in the beginning of the experiment.

Conclusions

(1) Our results show an extreme delicacy of discrimination below the level of the two-point limen. It is possible, for instance, to distinguish distances as near together as app-2, and 2-5.

(2) The subjects either were able accurately to distinguish between the cutaneous patterns or failed completely.

(3) The subjects were frequently unable to distinguish between the separations presented to them because of the fact that certain conditions such as physical disability, suggestion, temperature of the cast, etc., were operative. When these conditions were present it was impossible for the subjects to distinguish between the very widest separations.

(4) Very considerable changes in the limen, which have been ascribed to fatigue, are probably due to the fact that the object of judgment was not kept constant throughout the course of the investigation. The limen initially determined was in all probability not the limen of clear separation, but only some subliminal cutaneous pattern.

(5) We have been able to account for the divergent views held heretofore as to the effect of practice on the two-point limen. We have shown that the practice-effect of certain investigators is really not due to practice at all, but rather to a shift of attitude on the part of the subjects, involving their occupation at different periods of the investigation with different cutaneous objects.

THE LOCALISATION OF FEELING[1]

By P. T. Young

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Störring,[2] in 1905, basing his conclusion upon the reports of 3 subjects and also upon objective records, distinguished between *Empfindungslust* and *Stimmungslust*. His method was the following: "während man bei der Erzeugung von Lust, die an eine Geschmacksempfindung geknüpft ist, die Geschmackslösung während der Dauer des Versuchs im Munde behalten lässt, gab ich zum Zweck der Erzeugung von Stimmungslust der Vp. die Anweisung, die Lösung zu schlucken und dann von der Empfindung abzusehen, mit dem Schlucken den Geschmacksreiz als eine erledigte Tatsache zu betrachten." After a little practice, the subjects were able to carry out the instruction, and agree " dass an der unter den neuen Bedingungen entstandenen Lust die gesamten jeweilig vorhandenen Bewusstseinsinhalte teilhaben, während die unter den gewöhnlichen Bedingungen entstandene Lust an die Geschmacksempfindungen allein gebunden erscheint, die Geschmacksempfindungen zusammen mit der Lust sich als geson-

[1] From the Psychological Laboratory of Cornell University.

[2] Störring, G., Experimentelle Beiträge zur Lehre vom Gefühl, *Arch. f. d. ges. Psychol.*, 6, 1905, 316-32.

dert von den übrigen Bewusstseinsinhalten darstellen" Rose[3] in 1913, accepting Störring's distinction, defines "Stimmungslust als solche Lust, die das Gesamtbewusstsein okkupiert, und Empfindungslust als solche Lust, die eng gebunden ist an einen Empfindungskomplex." *Empfindungslust* is localisable: "Die Unlust ist ganz im Munde lokalisiert" (Vp. Btz.); "Vp. N. gibt an, dass sich die Unlust direkt und ausschliesslich an die Zunge knüpft." *Stimmungslust* is not localisable.

With *Empfindungslust* mixed feeling (coexistence of pleasantness and unpleasantness) is possible whether or not pleasantness (P) and unpleasantness (U) are antagonistic, for P and U may exist side by side as red and green in the same visual field. With *Stimmungslust*, however, mixed feeling is a question of the antagonism of P and U.

The experimenters recording mixed feeling also note that P and U may be localised. Nakashima[4] remarks that "a few cases of affective localisation occurred in the experiments by the method of single stimuli." Koch[5] states: "in unseren Versuchen finden wir, sobald die Versuchspersonen nur einige Übung in der Selbstbeobachtung erlangt haben, zahlreiche Fälle von Zuständen der Lust und Unlust, die deutlich lokalisiert werden." Wohlgemuth[6] notes that "*the feeling-tone is mostly localisable*. With tactile, pain, olfactory and gustatory sensations this is almost invariably the case with subjects R and F. Subjects P and J are unable to localise the feeling-tone at the beginning of the investigation, but as the training proceeds statements to that effect, become more frequent." Finally in our own investigation[7] of mixed feeling, localisation occurred in the reports of several subjects.

The following study of affective localisation is based upon the results of a previous study of mixed feeling, to which the reader is referred for method, divisions of the experiment, stimuli, and other details.

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[3] Rose, H., Der Einfluss der Unlustgefühle auf den motorischen Effekt der Willenshandlungen, *Arch. f. d. ges. Psychol.*, 28, 1913, 109-10.

[4] Nakashima, T., Contributions to the Study of the Affective Processes, *Am. Jour. of Psychol.*, 20, 1909, 184.

[5] Koch, B., Experimentelle Untersuchungen über die Mannigfaltigkeit der elementaren Gefühlsqualitäten, *Halle Diss.*, 1911, 90.

[6] Wohlgemuth, A., On the Feelings and their Neural Correlate, with an Examination of the Nature of Pain, *Brit. Jour. of Psychol.*, 8, 1917, 450.

[7] Young, P. T., An Experimental Study of Mixed Feelings, *Am. Jour. of Psychol.*, 29, 1918, 237 ff.

I. Quantitative Results

Percentage of Localised Feelings. Table I shows the number and percentage of reports containing localised feeling. Three reports (F, 2; G. 1) are ambiguous, and 1 (G) is doubtful. If we eliminate these equivocal reports, there remain 72, or 3.2%, localised feelings, reported by three subjects (H, F, K). Six of 9 subjects report no unequivocal localised feelings.

TABLE I

Percentage of Localised Feelings

Subject	B	Da	Di	F	G	H	K	O	W	Total
Number reports.....	193	275	242	252	232	242	307	278	191	2,212
Reports containing loc. feeling.....	0	0	0	19	2	51	4	0	0	76
Percentage.....	0	0	0	7.5	.8	21.0	1.3	0	0	3.4

Distribution of Localised Feelings. Table II shows the number of localised feelings reported on successive days of the experiment.[8] It will be seen that localised feelings occur in sporadic groups. Note the large group of H, days 4-9, and F, days 10-14. Note also the groups, extending for two consecutive days, of G, days 2-3, and K days 23-24. Apart from these well-defined groups, localised feelings are reported at random on single days.

Relation of Localised Feelings to Mixed Feelings.

The relation of localised feeling to mixed feeling is shown quantitatively by several facts. In the first place, the same subjects report both: unequivocal mixed feeling is reported[9] by F (4), H (4), K (21), O (2); unequivocal localised feeling is reported by F (17), H (51), K (4). In the second place, the distribution of localised feelings and mixed feelings is of the same type: both occur in sporadic groups throughout the course of the experiment and throughout the single experimental hour. In the third place, the groups of localised feelings and mixed feelings overlap; both occur on the same days. Table IV shows the coincidences.

In the fourth place, the percentages of mixed feelings and localised feelings are almost identical, although the overlapping is only partial. There are 3.2% mixed feelings[10] and 3.4% localised feelings in the experiment as a whole.

[8] For the total number of reports on these days see *ibid.*, 246.
[9] *Ibid.*, 244.
[10] *Ibid.*, 244.

TABLE II

DISTRIBUTION OF LOCALISED FEELINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
F	0	0	0	2	0	0	0	0	0	2	7	3	2	3	0	0	0	0	0					
G	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
H	0	3	0	1	4	2	21	16	1	0	0	0	0	0	0	0	3	0						
K	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1

Within the single experimental hour localised feelings tend to occur in groups of consecutive reports. Table III illustrates this tendency.

TABLE III

DISTRIBUTION OF LOCALISED FEELINGS WITHIN THE SINGLE EXPERIMENTAL HOUR

Subject	Day	Number reports	Reports containing localised feeling
F	10	16	152, 153
	11	14	165, 166, 167-172, 173-175, 176
	14	10	205, 206, 207
H	7	25	76, 77, 78, 79-81-83, 84, 85, 86, 87, 88, 89, 90, 91-94, 95,96, 97, 98, 99, 100
	8	26	101, 102-104, 105-107-110, 111-113-115-117-119, 120, 121-123, 124-126

TABLE IV

COINCIDENCES OF MIXED FEELINGS AND LOCALISED FEELINGS

Subject	F		H			K	
Day	11	13	2	5	6	23	24
Number of localised feelings	7	2	3	4	2	2	1
Number of mixed feelings	3	1	3	4	1	5	2

Of the 71 mixed feelings reported, 9 contain explicit localisation[11] of the coexisting feelings (H, 4; K, 3; F, 1; G, 1). Nineteen others seem to imply a localisation by the statement that the object-feeling is "attended to," is in the focus or background of consciousness, etc. The remaining 43 contain no statement regarding localisation. However, all of the "mixed feelings" are of an objective type of report, characterised by reference of P-U to an object and identification of P-U with an object; so possibly in some cases localisation is taken for granted and not reported. The feelings may be localised in the following mixed-feeling reports, for example, although there is no specific mention of *place where* as regards P and U.

"You have the U from one field and the P from the other" (H 16). "Slightly P from the body and a more intense U from the sandpaper; seemingly two disparate things" (H 18). "It seemed that the sweetness of the odor and its piquancy were there at the same time—P and U" (O 135). "It is difficult to say whether just the odor was there or whether a P odor was there" (O 140). "The bitter and the sweet were there side by side and I think the feelings were there" (W 50).

We conclude (1) that the subjects show marked individual differences in the tendency to report localised feelings, (2) that localised feelings are reported sporadically in groups throughout the course of the experiment and throughout the course of the single experimental hour, and (3) that there is a very close quantitative relation between mixed feelings and localised feelings.

II. ANALYTICAL

Qualitative Differences of Feeling. Some of the subjects, especially G, report qualitative differentiation of Ps and Us.[12] Following are examples:

[11] *Ibid.*, 260. Seven of these reports are printed in full.

[12] By a mere chance the qualitative differences recorded are between Ps; there are very few qualitative differentiations of Us in our protocols.

"The tactual sensations were P in quality and exciting. I had a different quality of P . . . a comfortable feeling" (G 41). "The first was a much livelier P than the other; it seemed closely connected with the bodily attitude of attending and it hung over while the other P that I would call comfort came in" (G 121). "At first an agreeable P and then a lively P with an amusing aspect" (G 150). "At first a very lively P with strong organics of even intensity. . . . Then the P started again; this time much quieter than before. It was made up partly of enjoyment and partly of relief" (G 154). "The first P was satisfying. Then the quality of the P changed with the coming of the second experience; I got quite strong exciting P with amusement. Then I seemed to get a shift between the quiet sort of P and the exciting. Sometimes the quiet P was in the focus and the other in the background, and then the tables were turned and the other P came to the focus with the quiet, comfortable P in the background" (G 157). "A feeling of well-being. Then another P which had a different quality; it was a soothed feeling. Then some of the first P came again and the other dropped out." (F 197). "A big shift in feeling. A strong suggestion of two qualitatively different Ps, but I'm not sure" (B 143). "Both experiences were P: one was a tickling P and the other was a soothing P. You seem to get the body divided; all down the central core and on my left side I could feel the smooth, swaying rhythm of the movement. Whereas, at the right of the head and shoulder there was this P tickling feeling like quick vibrations running all over you" (H 73).

Subject F reports qualitative differences of a different order between object-feelings. "Feeling" is equivalent to "what the object suggests," "what it is like," "how it makes one feel," "what it makes one want to do," etc. "Feeling," again, is sometimes described in sensory terms. There is thus a double confusion (1) between meaning and feeling, and (2) between sensation and feeling. In the following examples compare the stimulus with the "feeling" it evokes:

(Water on face) "U, a cold feeling, a feeling of being disturbed" F 76. (Bite of banana) "P, a soft, velvety, cold feeling; it was much as if someone had put something into your hand that was soft and velvety and cold" (F 89). (Asafoetida) "U, an irritated feeling. You feel as you feel when you are peeling an onion" (F 90). (Fife) "That's the feeling that makes your teeth go together. It makes you shrink and sends shivers up and down your back. It makes you feel gritty all over; you feel like jumping up and stopping it" (F 92). (Hot brass on cheek) "That's U. It makes cold chills go up your back. It feels burny, hot and inflamed" (F 94). (Quinine) "U, a drawn-up feeling as if you were being squeezed; a withered feeling. You feel as if the corners of your mouth were drawn down" (F 97). (Peppermint candy) "Very P. It makes you feel soothed, soft and velvety. It makes you feel very happy, elated, expansive, as if you had won a victory" (F 98). (c, e, g, c'.) "The same feeling as listening to a harp" (F 99). (Rattle) "That's U, a chaotic feeling" (F 103). (Odor coffee) "This is P. I felt as if I were taking coffee; a smoky feeling in the throat" (F 122). (Odor turpentine) "This is P. I feel as I feel when I walk through a newly-painted house. A spicy, refreshing feeling" (F 123). (Sight of dead rabbit) "A sym-

pathetic U. It makes you feel the way you feel when you see a dead cat" (F 126). (Nitrobenzole odor) "This is P, a spicy, peppery feeling" (F 133). (Pressure cotton) "A soft, soothing feeling" (F 140). (Sarsaparilla, stale cheese). "At first a sweet, sickish feeling and then a disgusting organic feeling" (F 155).

Types of Localisation. There are four types of localisation, which are described below.

1. P and U may be localised at the place of the stimulus-object. Following are examples:

(Taste of salt solution) "U, a drawn-up feeling . . . localised in the mouth" (F 152). (Odors: cinnamon *plus* asafoetida) "It is as if one were in each nostril. On the left I got P and on the right I got U" (F 166). (Chord c, e, g, c') "P seemed in the center of my head" (F 175). (Pinch nose with clothes pin) "U localised in my nose. An explosive feeling as if you were stopped up and going to explode" (F 176). (Shrill fife) "The U was localised inside my head between the ears" (F 178). (Rap on forehead) "A pain U was localised in the head" (F 185). (Sharp nail on cheek) "A U localised on the cheek" (F 197). (Taste solution alum) "A drawn-up feeling localised in the mouth" (F 205). (Sandpaper teeth) "Then U localised in my teeth, an annoying feeling" (F 207). (Shrill fife) "U. The experience seemed to be in the head; the feeling was localised in the head; the U was in the ears" (H 78). (Asafoetida) "U, purely in the nose and throat" (H 81). (Bite of banana) "The P was part in the stomach and part in the mouth" (H 83). (Sandpaper forehead) "Mostly felt—in the sense of affection—at the point of contact. Some feeling seemed to come from between the shoulders" (H 87). (Peppermint candy) "P; a mild feeling pretty much limited to the mouth" (H 98). (Odor vanilla) "Mild P, confined pretty much to the head and throat" (H 107). (Burn hot brass) "Purely a pain U, localised distinctly at the point of contact" (H 115). (Sandpaper arm, perfume) "U on my hand and P with my nose" (K 12). (Velvet on one cheek, sharp nail on other) "The feelings were localised in the cheeks" (K 312).

2. P and U may be localised organically, remote from the stimulus-object. Following are examples:

(Perfume, H_2S) "P localised along the spinal cord" (H 23). (Torture, perfume) "The perfume was very, very P and it was as if you felt it in the center of your body right up through the viscera. The U seemed to be confined more to the outside muscles—the skeletal muscles" (H 58). (Torture, perfume) "The P was a weak central core in the middle of me. The P did not extend below the thorax. The U was all over the body, even to the feet, only it didn't get inside of me" (H 60). (Imaginary stink, perfume) "I had a kinaesthetic experience then as if I were being pulled apart; it was U. It was well down in the abdomen whereas the P was felt in the upper part of the chest" (H 67). (Metronome, largo 42) "An irritating U; the feeling was in the legs and arms" (H 79). (Anise odor) "P, very mild and soothing, in the middle part of the body. The periphery of the body does not seem to be involved but rather the central part" (H 96). (Odor stale cheese) "Quite strongly U. The feeling experience seemed to localise above the stomach" (H 113). (Peppermint candy)

"P, mild but soothing. It was confined to the column in the center of the body" (H 126). (Picture mural decoration) "The pleased aspect was localised peripherally" (H 235).

3. P and U may spread out or radiate from a given center so that they pervade the body. P and U may also move up and down the trunk or across the body. Following are examples of irradiating and moving feelings:

"One of those Ps that I feel through the entire trunk of the body. It begins at the bottom of the body and works up" (H 7). "A slightly nauseating U particularly in the stomach. It spread itself out to most of the body" (H 84). "It is all up and down the main part of the body. It doesn't affect the arms much but it does extend to the legs" (H 85). "A mild, soothing P from the lower abdomen up—not including the arms, however. It was stronger towards the top of the body and seemed to fade away at the lower part" (H 88). "A moderately strong feeling of U. It was felt more particularly through the chest. Most of those feelings go up and down but that feeling ran through from right to left" (H 89). "A sickening, nauseating U. It was localised more particularly in the stomach but was felt all over the body, somewhat in the lower limbs" (H 91). "P confined to the head. A tendency for the feelings to go down the body" (H 101). "The U experience is localised more particularly at the base of the spine. A jerky thing that runs out through you seems to be the U" (H 104). "P localised in the chest, in the upper part of the trunk. It had a radiating attribute" (H 105). "The U seems to center pretty low in the body near the base of the spine" (H 117). "The feeling experience is quite bodily with its focus at the ear" (H 119). "Moderately U; up and down the spine" (H 121). "At first the U was merely in the mouth but quickly it passed to the body. The feeling seemed to pervade the body" (H 123). "U; it became more generally diffuse throughout the body" (H 128).

4. P and U may be wide-spread over the whole body, diffuse, general. Following are examples:

"U, the whole body revolted; I felt it all over" (H 56). "An ephemeral sort of P. You feel it all over you . . . the P doesn't seem to attach to anything; you are immersed in it" (H 63). "Quite P, a pervasive feeling-tone. It pretty much fills the whole experience" (H 77). "U, a general feeling of withdrawal, pretty much over the whole body" (H 99). "The U increased and was pretty much all over the body. It was as low as the knees" (H 100). "U . . . it seemed wide-spread" (H 111). "U. I feel that all over; the whole body was involved. It was not general at first but just local" (H 124).

All of the localised feelings of F, G, and K are of the first type. The illustrations of types 2, 3, and 4 are taken entirely from the reports of a single subject (H).

Characterisation of Object-feeling. The object-feeling may now be characterised by (1) a form of report[13] that refers P-U to an object or identifies P-U with an object, (2) qualita-

[13] Young, *op. cit.*, 253, 259.

tive differentiations, sometimes described in sensory terms and sometimes as meanings, (3) localisability, (4) compatibility of P and U object-feelings, and (5) the fact that the object-feeling may be attended to,[14] or in the background or focus of consciousness.

Localisation is thus one characteristic of the object-feeling. Object-feelings are *localisable* but not always *localised*.

III. Discussion

Dependence of Qualitative Differences of Feeling Upon Sensory Components. Qualitative differentiations between object-feelings depend upon sensory elements, especially organic and kinaesthetic, which are part of the total "feeling" experience. This dependence is shown in the following:

"I am sure there was a difference in sense-feeling. I found it difficult to separate feeling from sensory component, and I got the impression that there was a quality-difference between the two Ps. The first was soft and voluminous, the second was biting and pungent" (W 124). "The U was more like a pain sensation than like a U feeling. The pain is U, but it doesn't set up the kinaesthesis that usually accompanies intense U" (H 49). "It seems that the organic sensation *is* the P localised" (H 148). "The P changed somewhat in character; it appears to be organic" (H 155). "There was soothing P. The soothing is kinaesthetic and organic. The kinaesthesis is around the throat and diaphragm" (O 202). "The amusement hangover seemed kinaesthetic and not feeling. I believe I have before reported the kinaesthesis of amusement as a P feeling" (K 230). "It seems as if I could correlate degree of feeling with degree of something down in the abdomen" (B 182). "P with a stimulating quality in it. I think I could analyse the stimulating quality into bodily things. What it amounts to is that I am suddenly more conscious of the upper part of the body" (G 98). "The U seemed brighter and had more body to it because (I think) I got kinaesthesis in the neck and forehead and pressure about my nostrils" (G 99). "The U seemed brighter because of the bodily context it had" (G 103). "At first I got just cold moving contact, very U, and kinaesthesis in my throat. The U seemed more attached to the sensory components whereas the P had become a more independent state. It was connected more with a widespread bodily complex; it had become more nearly bodily comfort than P" (G 57). "First P in the sense of being satisfied; the bodily counterpart of satisfaction was in the thorax. Then an intense U with a being-disturbed aspect; being-disturbed was being caught in taking a breath, a strong tension in my throat" (G 137.)

So far as our results go, qualitative differentiations of Ps and Us depend upon the sensory elements in a total feeling experience. As to the number and *order* of the elemental affective qualities (abstracted from sensory components and meaning), we await further experimental results.

[14] *Ibid.*, 260.

Dependence of Localisation of Feeling upon Sensory Components. That localisation of feeling depends upon localised sensory components, especially organic and kinaesthetic, may be clearly demonstrated in the case of H. During the first 6 days of the experiment H reported 10 cases of localised feeling (Table II). On day 7 the first 3 reports contained localised feeling, after which O was instructed "to watch and report Ps and Us that have a place or locality." Possibly this instruction acted as a suggestion; for, of the remaining 22 reports given on this day, 18 contained localised feeling! On the following day, having reported 4 localised feelings (the last in the chest region), H was asked: "When you speak of 'feeling' do you mean muscular and organic sensation?" H replied " . . . The P actually seems to come from the chest region; it seems to be there." [Two days later, however, he reported: "It seems that the organic sensation *is* the P localised" (148).] On this day (day 8) 16 localised feelings were reported out of 26 reports. On the next day (day 9), the second report given was of localised feeling, after which H was instructed "to abstract from organic sensation and report feeling." The instruction was almost immediately carried out, for the change in type of report is very marked. The remaining 16 reports on this day contain not a trace of localised feeling. And throughout the rest of the experiment (except on day 17; see Table II) there is no more localisation of feeling. Just as soon as organic sensation was abstracted, and feeling reported for its own sake, localisation disappeared.[15]

With F, localised feeling disappeared (day 15) just as abruptly as with H. The disappearance, however, occurred on the first day that picture stimuli[16] were used. F's feelings had been localised exclusively at the place of the stimulus-object, and when pictures were substituted for odors, tones, tastes, pain, etc., the feelings ceased to be localised. But, quite apart from this sudden change of stimuli, the reports of the latter section are psychological;[17] feeling is reported

[15] H's mixed feelings disappeared after day 6; his localised feelings did not disappear until day 9. The explanation of this disparity is probably that the conditions were not favorable for mixed feeling on days 7, 8, and 9, since the work on these days was with a single stimulus. H's mixed feelings are mainly of the localised object-feeling type.

[16] Picture stimuli seem to be unfavorable to localisation of feeling. Relatively few localised feelings are to be found in the protocols of Kellogg (see Young, *op. cit.*, 259, note 37). Kellogg used visual stimuli exclusively.

[17] Young, *op. cit.*, 252.

for its own sake with no reference to object; no localisation is to be found in this section.

Conclusions

Störring's distinction between *Empfindungslust* and *Stimmungslust* thus appears to be a distinction between the unanalysed object-feeling of common-sense, and the psychological report of affection (abstracted from other elements). *Stimmungslust* was obtained by instructing the subjects to abstract from the taste. When P and U are regarded independently, there are no localisation and mixture, for localisation and mixture depend upon the sensory object.

We conclude:

(1) P and U are not localisable. Localisation and extent are characteristics of the unanalysed object-feeling of common-sense.

(2) Localisation and also qualitative differences of feeling depend upon sensory components in the total feeling experience. The popular term "feeling" includes localised sensation as well as meaning.

(3) Localised feelings are reported rarely; six of nine subjects report no unequivocal localisation of feeling. Localised feelings occur in groups sporadically throughout the course of the experiment and in consecutive reports throughout the single experimental hour. The quantitative results show a close relation between localised feelings and mixed feelings.

ARISTOTLE'S OTHER LOGIC

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The science of Euclid's geometry was not infrequently pointed to in times past as a system of truth from which doubt had been forever banished. It was within the domain of space relationships that the greatest of the Pythagoreans had found his eternal truth[1] and for two millenniums following Plato's day the science of space had remained one of the chief strongholds of the absolutist's creed. It was a matter of no small concern, then, to pragmatic philosophy, that this science should in course of time have been successfully denied and other geometries created upon the ruins of the old; for thus had been destroyed in a very critical instance the ancient prejudice that all of the truth about anything can be contained within a single point of view. Cut loose from his geometric, and, as it turned out in the sequel, from his mechanistic moorings as well, the true lover of " things-in-themselves " had little left to turn to save that other science, which, begun by Aristotle, had been completed by the Stagirite within the span of his own life. If the fifth axiom of Euclid was self-evident, how much more that valid syllogism which goes by the name of *Celarent!*

For the benefit of those who may never have heard of those verses within whose cabalistic stanzas lie buried the valid forms of inference, let us spread out the mood to view:

> If (major premise) no *b* is *a*
> and (minor premise) all *c* is *b*
> then (conclusion) no *c* is *a*.

This inference, being true generally, will remain true for special values of the terms. Thus, if *b* is the same as *a*, the major premise seems to be untrue for all meanings of the terms, and the professional logician explains this seeming paradox by observing that if an impossibility be true then any conclusion will follow and this particular one along with the rest. If *c* and *a* be made identical the conclusion becomes untrue and our syllogism takes the form:

[1] *Τοῦ γὰρ ἀεὶ ὄντος ἡ γεωμετρικὴ γνῶσίς ἐστιν.*

If (major premise) no *b* is *a*
and (minor premise) all *a* is *b*,
the (conclusion) an impossibility is true

and this is interpreted to mean that "No *a* is *b*" and "All *a* is *b*" cannot both be true. If the contradictory of "a proposition that is untrue for all meanings of the terms" be "a proposition that is true for all meanings of the terms," then a familiar logical transformation will yield the result: it is true of necessity that "Some *a* is *b*" or that "Some *a* is not *b*."

It is by such devices as these that the "repeaters of Aristotle" might be expected to avoid the pitfalls of special cases and so maintain the complete generality of the science which they profess; and they might have succeeded to the end, had it not been that some ingenious meddler in the affairs of the understanding suddenly produced, and as suddenly held up to view, the notion of a class which has no members, and as illustrations of this hybrid of the imagination, which he called the "null-class," he pointed out the class of triangular circles and the class of alien Americans. Opposed to this class is another, which he called the "universe" and which contains the members of all other classes.

If we push our excavations further within the tumulus of that old mnemonic line there will soon come to light the mood of Ferio, and if we take the pains to identify the terms in the conclusion of this mood, it will appear, when spread out on the page, like this:

If (major premise) no *b* is *a*
and (minor premise) some *b* is *a*,
then (conclusion) an impossibility is true.

At this point we may allow to enter the null-class and the universe in order to try them out as special cases. Suppose that *b* represent *nothing* (null) and that *a* represent *everything* (universe). Our syllogism will then have to read:

If (major premise) none of nothing is everything
and (minor premise) some of nothing is everything,
then (conclusion) an impossibility is true.

Now, it is commonly taken to be a property of the null-class that its members are contained among the members of any class whatsoever and that they are all completely excluded from among the members of the universe. Hence each premise in this case is a true proposition and consequently this mood of the syllogism is invalid, which is the logician's way

of saying that the conclusion does not follow from the premises. The "repeaters of Aristotle" have always insisted that the two premises in question represent contradictory forms of judgment, by which they mean that one of the two is true of necessity and that they cannot both be true together. But here is an instance of their both being true and no impossibility implied, and to have pointed out such an instance is to have pointed out the necessity of a logic which is not Aristotle's own.

The propositions, which are fundamental in the Aristotelian scheme may be expressed as follows, (representing the four categorical forms, as is usual, by A(ab), E(ab), I(ab), O(ab); the small *a* standing for subject, the small *b* for predicate):

I. A(ab) *is true* and O(ab) *is true* is impossible
E(ab) *is true* and I(ab) *is true* is impossible,
A(ab) *is false* and O(ab) *is false* is impossible,
E(ab) *is false* and I(b) *is false* is impossible,
II. A(ab) *is true* and E(ab) *is true* is impossible,
A(ab) *is false* and E(ab) *is false* is not impossible,
III. I(ab) *is true* and O(ab) *is true* is not impossible,
I(ab) *is false* and O(ab) *is false* is impossible,
IV. A(ab) *is true* and I(ab) *is true* is not impossible,
E(ab) *is true* and O(ab) *is true* is not impossible,
A(ab) *is false* and I(ab) *is false* is not impossible,
E(ab) *is false* and O(ab) *is false* is not impossible.

Propositions I enable us to say that A, O and E, I are *contradictory* pairs; II that A and E are *contraries;* III that I and O are *subcontraries;* IV that A, I and E, O are *subalternate* pairs.

The simplicity of the system depends on the fact that corresponding to any member of the set, A, E, I, O there is another member of the set, which stands for its contradictory; or otherwise, any categorical form, x(is false), may always be replaced by another categorical form, y(is true), and conversely. It will be seen, however, that this advantage is lost, as soon as subject and predicate are assumed capable of taking on the meanings "nothing" and "universe," for under these conditions not all the propositions under I, II, III, IV, remain true.

It is customary, because of this breakdown of the common logic, to regard the classical scheme of inference as one which excludes "nothing" and "universe" as possible meanings of the terms. We wish to indicate that this view is correct, by

pointing out that the traditional science is a special case of a more general system of inference, one, viz., which does not exclude these meanings of the terms, and whose denotation or application is consequently of larger extent.

We observe, in the first place, that *some a is not non-a* is not necessarily a true proposition, in virtue of the fact that there is nothing in the definition of the null-class to prevent our postulating it as false, when *a* stands for "nothing" and non-*a* for "universe."

In such a logic, a logic whose fundamental postulate would be "*some of nothing is not everything is a false proposition*," all of the propositions I-IV, as well as all of the twenty-four moods of the syllogism, which are commonly taken to be valid, remain valid. It might appropriately be called *semi-Aristotelian* logic, because it not only retains all the characteristics of the traditional system but is able as well to interpret those new meanings, which have been introduced into the science since its inception. This name will also serve to distinguish it from a group of logics, whose existence I shall point out in another place, and which would best be called non-Aristotelian, because the characteristic postulate of each member of the group stands in contradiction to those of common logic and to those of each other member of the group.

SIXTEEN ORIGINS OF THE MIND

By J. F. DASHIELL, Oberlin College

Present-day psychology, physiology, philosophy, and theology —not to mention various social sciences and natural sciences— are cast largely in terms of a body-mind dualism. Representative works in each of these branches of learning seem to presuppose a radical distinction between what is called variously physical, material, bodily, non-conscious, objective, and what is called psychic, spiritual, mental, conscious, subjective. Not that the terms grouped together in either member of the division are synonymous; differing connotations render them now one, now another, appropriate for specific uses; but a core of common meaning is recognizable. The man of the street, too, has caught this point of view from the man of the study; and nothing is more common to common thought than the idea of man as having a dual constitution, his mortal frame and the indefinite but intimate tenant thereof.

Various considerations, however, are leading critical minds to question the validity of the distinction as a hard-and-fast one. The problem is one of the deepest and hardest of our science, and its answer necessarily determines strikingly our interpretations of psychological data. We need not go into these considerations, nor the particular sorts of demolitions and reconstructions urged by various critics. But it would be conducive to a clearer apprehension of the general problem to trace back the distinction of mind and body to its manifold roots—roots in unreflective as well as reflective manners of thinking, primitive as well as sophisticated.

'Psychical,' 'spiritual,' 'mental,' 'conscious,' 'subjective,' etc., etc., are words representing a single broad and general category; at the same time they imply different emphases. We may accordingly expect to find that the various human motives that, taken singly, appear more or less sufficiently obvious as the creators of the distinction, when brought together seem rather strange bed-fellows. And we may expect to have to go to a variety of authors for our material.

Our question will be: *What considerations and motives have, or seem to have, led man to the conception of the 'mental,' etc., as a distinct category?* Looking for points wherever

they may be found, we may expect to explore different realms strange and far removed.

1. The earlier anthropologists of the English school have made much out of the primitive savage's perception of certain striking differences in the behavior of his fellows. Certain faculties are manifested by them at some times, not at others. How vastly different are the warrior living and the warrior dead, the mighty man awake and asleep, the same fellow in normal activity and in the puzzling and mysterious trance, even the same one in health and in disease! Phenomena such as these, where the same individual of gross outward appearance seems now freely and positively active, now negatively inert and passive, led to a vague feeling of the alternate presence and absence of some hidden power or agency. And this power or agency came to be felt as the man himself in the most intimate sense, inspiring the body in the moments of its wakeful life, forsaking it temporarily in sleep or permanently at death.

2. This Tylor-Spencer brand of anthropology had ready another interpretation of animism complementary to the preceding. Primitive emotions are easily aroused by the rather puzzling duplications which are to be seen in dreams, visions, and imaginations of the shapes we know in normal life. His comrades and his family are for the savage a part of the day's experiences, but at times he sees these same comrades and family appearing to him in more shadowy and diaphanous as well as more capricious character. Consider also the shadows that stick closer than brothers representing more or less faithfully the human silhouettes and the images-in-pools that give back even more faithful duplicates. There spontaneously arose, consequently, a feeling—we will not say a reasoned belief—that somehow man had his other—his "shade," as it came to be called sometimes among civilized peoples. That there are shocking inconsistencies and lacunae in the thinking here is understood by merely reminding ourselves of the highly impulsive, emotional, and unreflective character of primitive attitudes.

3. In this connection one should remember also the dream theory. Our typical savage lies down in his hunger for a nap. But after the world has begun to swim before his eyes, he may find himself suddenly in the progress of an absorbing hunt, fully equipped and with dog at heels. It may be an exciting chase and the climax may occur with the game laid low. Sooner or later, however, our man finds himself unhappily dispossessed of his winnings and stretched out most

prosaically on the floor of his tepee. He may attempt to describe his adventures to his friends, but they solemnly enough assure him that he has not once left his tent. What is he to make of it, then, unless it was only his outward husk that lay uninterruptedly in the tent as his soul went hunting on?

4. The assumption of indwelling souls in the bodies of others has received partial explanation further in the introjective theory. A observes in the natural course of experience that the actions of various items of his world are very similar to his own behavior, and by crude analogy comes to assume back of actions intents, purposes, ideas such as guide his own behavior. From the observed fact of a similarity of bodily performance there is an inference beyond to states of mind similar to his own. This is an explanation of the development of other minds, and plainly enough presupposes some sort of preliminary recognition of one's mental self. Certainly it is a sophisticated interpretation.

5. The value-aspect of experienced objects as the ground for their assumption of "mental" characters would seem to be more in keeping with the natural movement of naïve thought. According to this doctrine, in all uncritical experience our "objects" are felt to be overflowing with emotional characters: they are first of all *values* and only by cold processes of abstraction bare *things*. The heavy wind, the root that trips us, are obstinate hindrances unfriendly to us; as Santayana says, "Before he is a substance the sun is a god." And animal and human beings, the latter especially, show these characteristics especially well; accordingly they are felt as dynamic agencies in a peculiarly vivid degree. The various emotional dispositions they show are found to be more or less centered and unified at bottom. This unification, again, is more or less in terms of an essence or agent—a *mind* or *soul*.

6. The Greek sophists had made much of the relativity of sense-qualities and hence their subjectivity. To err is mental. A reason commonly assigned by latter-day epistemologists for the development of the conception of the subjective as a more or less distinct realm, is that from illusions and errors. Original experiences are frequently found upon reflection and examination to have been false. At the time, I was seeing my friend approach, yet later evidence proves that it was really a stranger. But he *was* my friend! Now, a single, one-piece, close-knit, neatly self-consistent universe such as the kind we generally assume, most of us, in our daily think-

ing, would have no place for such glaring contradictions. That friend I saw was not really a part of the real world—he was only subjective. Pressed further, this develops into a distinction between the world and the mind, wherein the former becomes a sort of dumping ground for the "erratic residue of experience."

7. Another source of the subjective, as alleged by present day thinkers, has been called the "physiological argument." A little study of psychology shows how the sense-qualities of objective things are dependent upon the integrity of the sensory nervous organization of the percipient. But this nervous organization in itself is absolutely unlike the observed qualities; hence it would appear to be an impenetrable barrier between the quality *as observed* and the quality—or whatever it be—as existing in the real world. What are we going to make of it unless we accept such barrier as fact and admit the contemporaneous existence of the world of pure fact and the world of the psychical?

8. But even within the realm of the psychical, say some, a dualism arises. Logicians have made fundamental to their discipline a distinction between subject and object, between knower and known. Mere knowledge standing on its own legs is impossible, it is *ipso facto* known by some one. Conversely, a knower can't exist *per se*, he is a knower *of* something. Knowledge, then, is a relation, a relation between knower and known, implying both the more or less independent existence of the two terms of the relation and their juncture in some sense by virtue of the knowing function. The knower here has frequently been called the rational self.

9. Not greatly different is the dualism arising from the experiencer or agent that lives through various experiences and the divers experiences themselves. Certain sets of experiences we recognize as somehow all together belonging to Jack, others to James, the Jack experiences naturally joining each other in a continuous series, and the James likewise. This articulation of experiences, this phase of consistency and permanence and progressive organization running through them, has been taken as the self or the purely subjective.

10. Another form of duality may be found within conscious experience. Reflection shows us experience as private and experience as public. As indicated in 6 above, the way things first appear in naïve experience shows many manifest inconsistencies; there arises then the motive to construct a standard world. Sciences arise as partly inspired by this motive.

Chronology, for instance, early fixed upon certain more constant periodic changes by which the more capricious might be compared and organized into a self-consistent Time. The world which has come to be received as the real world is that which has been developed by social concurrence and perpetuated by social tradition; while the world that we individually know in its partial aspects and conflicting phases is not real but merely mental. The sun, we know, doesn't rise and set in the real world: its rising and setting is only a subjective fact, it is in the mind.

11. The individual as the source of the subjective is shown in a different way by a general survey of the history of thought. In ancient times institutions were emphasized, and likewise those ideas that were more general and abstract were called the more real. To the Greek, particularly of the Platonic type, the universal was the real, the individual was the unreal. These truer realities, these abstract ideas, came to be hypostasized, if not definitely and unmistakably by Plato at least by the Schoolmen. But with the Renaissance the modern world recognized individuality more, and everything came to be described from the standpoint of personal experience. Individualism became rampant in the 17th, 18th, and 19th centuries; and this warped the current psychology into the brand that took as the most assured realm of reality the 'psychic' 'ideas.' This forms a large share of our 20th century psychological heritage.

12. A more ancient root of the distinction is traceable to the time of the Atomists, and the argument presupposes their metaphysics. Empedocles posited material elements out of which all things are composed. These elements he felt, however, to stand in need of motive power, and love and hate were posited as forces in virtue of which they combined and separated to form the complex items of the world. Anaxagoras went a step farther by finding the principle of combination not in the elements themselves but in a Mind over all, giving them their initial impulsion, leaving them to continue the movement in their higher complexities. Thus, from a consideration of material atoms and their supposed inability to enter of their own accord into combinations to make up the world we know, the mind was hit upon as the source of the needed energy.

13. The Ancients suggested another conception of the soul. It was the 'entelechy' of the body. The essential nature of man's body, its true purpose, was realized in what we call his soul. The body's interests are given expression in its soul.

A modern variant of this theme is the vitalistic conception in which, so it is often said, the true interpretation of the body is to be sought in its *élan vital,* its inherent tendency to strive and push forward, to have life and have it more abundantly. This is the animating soul of the physical body. To approach it directly and intimately we need only look into our own consciousness, where we find non-materiality, non-spatiality, etc.

14. Lately there have arisen thinkers who trace the distinction between the psychical and the physical back to differences discernible in the overtness of actions. The *raison d'être* of ideas, thoughts, etc., is as guides to action; or better, they *are* incipient actions, not yet advanced beyond the mere nascent stage to that full maturity which is overt and observable to others. And an intention that has realized itself, that has passed over into the outward action it foreshadowed, is no longer viewed as a psychical but as a physical process. There is an unbroken continuity of mental and motor life, and the distinction is a relative one. Doubtless a genetic consideration has been operative here: the more primitive organic responses are characterized as nearly mechanical and invariable and stereotyped, whereas with the development of mind, in race and in individual, increasing plasticity and modifiability is evidenced. Description of the former general type in terms of overt and observable behavior may be fairly exhaustive, but the latter, just because they involve an initial element of delay for the decision to be reached, are not in their nascent and crucial stages objective. They are subjective.

15. The analysis of the process of reasoning as it has been made of late years brings out a somewhat different aspect of the same general point. Thinking, it is said, is always evoked by a difficulty, a problematic situation, and its operations are ultimately pointed toward some solution. Many psychological processes are involved here besides those traditionally included under reasoning. Memory, for example, furnishes former experiences as a basis for the development of alternative possible resolutions of the problem, and these alternatives are legitimate products of imagination projected as possible futures. As yet they are only possible, only mental. But when the conflict is ended and an answer adopted and made actual, this adopted course is then real, it is physical.

16. Now for a final suggestion! We may consider those moments so fraught with future consequences when the man of lowly estate learns by chance that he is an efficient agent

in regard to his environment, that he can effect some changes quite on his own account. He has discovered his mind. This realization is spasmodic at first; it is in need of disciplining and man learns his power more accurately through frequent failures. The history of social groups is punctuated by rediscoveries or renewals of this insight. The dawn of the modern era, for instance, is peculiarly well represented by a new realization of the powers of the human reason, even if it be an exaggerated confidence therein, and a search only for the correct *method*. The control and manipulation of outward circumstances, then, may be called the mental, or better, the spiritual, character of our nature, as opposed to the material upon which we operate.

This is a very sketchy survey. It was not intended to elaborate the different points of view but merely to suggest them. In these days of reflective criticism of the category of ' mind,' it may not be without some advantage to have pointed out the different possible sources of the category. That I have given an exhaustive analysis and list I would not pretend. I hope I have carried the division far enough for purposes of suggestion. Which of these motives seem valid—or rather, just what sorts of interpretation of the words ' mental,' ' psychical,' etc., are to be given weight now—that is another question and a fundamental one for psychologists.

MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF CORNELL UNIVERSITY

Communicated by E. B. TITCHENER, H. P. WELD and E. G. BORING

XLIII. A Preliminary Study of the Psychology of Heat

By F. CUTOLO, JR.

The current view that heat is conditioned upon the simultaneous stimulation of warm and cold spots derives in the main from the work of Alrutz. He employed an areal stimulus which was adequate both to warmth and to paradoxical cold. When this stimulus was applied in a region where there were only cold spots, he found only cold; where there were only warm spots, only warmth; but where there were both cold and warm spots, he found a resulting experience which he calls a *Hitzempfindung* and which he regards as unique and not further analysable. "Pure introspection," he says, "tells me not only that 'hot' is something different in regard to quality from warm, and that hot can very well be experienced without pain (although pain often *does* accompany it), but also that hot is a simple sensation which *generally* cannot be cut up or analysed into component parts." [1]

Alrutz also refers to certain experiments of Thunberg which he accepts as supplementing his own. Thunberg had simultaneously stimulated warm and cold spots by means of a flat coil of two small metal tubes. Through the one of these he ran warm, and through the other cold water, the temperatures being 44° and 24°C., respectively. Upon stimulation with this apparatus he got an experience which was "as if the temperature was suddenly raised and a feeling of 'hot' ensued." Coupled with this was "the sensation of a burning sensation about to arise." Thunberg, however, has never accepted Alrutz' notion of the *Hitzempfindung;* on the contrary, he regards the experience as a *Mischempfindung* which has the coloring of the stronger component, and which with sufficient practice may be analysed.[2] In this opinion he is supported by Kiesow, who explains the rise in intensity of the warmth in Thunberg's experiment as a contrast phenomenon, and the anticipatory "burning" as due to imagination. Kiesow thinks, moreover, that there may be all sorts and degrees of fusion among the various cutaneous qualities, and that cold and pain (whose limen varies at different parts of the body) are of especial significance for the qualitative coloring of these fusions. In illustration of the variation in the limen of pain, he gives the following instance, which, as we shall later see, may be of considerable importance: "Tauche ich die Nagelphalange des linken Zeigefingers in Wasser, das constant auf 49°C. erhalten wird, so bemerke ich nach wenigen Secunden auf der

[1] S. Alrutz, *Upsala Läkareförs. Förhandlr.*, N. F., 2, 1897, 340—359; *Mind*, N. S., 7, 1898, 141—144; *Skand. Arch. f. Physiol.*, 10, 1900, 340.
[2] Thumberg, *Upsala Läkareförs. Förhandlr.*, N. F., 1, 1896, 489 ff; Nagel's *Handbuch der Physiol. des Menschen*, 3, 1905, 707.

Dorsalseite, an den Rändern, vorn unter dem Nagel ausgesprochenen Schmerz, während dieser auf der Volarseite des Fingergliedes nicht auftritt. Lege ich die Volarseite der Phalange auf die Oberfläche des Wasser, so muss ich dasselbe bis auf 51°—52° erwärmen, um hier Schmerz zu empfinden. Zuweilen kündigt sich dabei die Schmerzempfindung an, *ohne deutlich ausgesprochen zu sein.* Diesen Zustand habe ich als *schmerzbetont* bezeichnet."[3]

Heat, for Kiesow (who has repeated Alrutz' experiment), is always obtained from temperatures near, at, or above the pain limen, and is therefore either *schmerzbetont* or painful; it is different from the characteristic "vollwarme Empfindung;" and at 45° occurs a complex which sometimes breaks up under analysis into warmth and cold, sometimes shows only a fluctuation of these two qualities.[4]

The issue is plain enough. All three observers agree that with areal stimulation there may be a mixture or fusion of cold and warmth, but they disagree as regards both the simplicity or complexity of the experience and the qualitative nature of heat.

In our own attack upon the problem we have employed two methods of stimulation: (1) a punctiform simultaneous stimulation of warm and cold spots, a method which has not heretofore been used and which would seem to simplify the issue; and (2) a repetition of Thunberg's experiment, substituting for the coil a grill of warm and cold stimuli. The observers were E. G. Boring (B), instructor in psychology, who has had long experience in qualitative descriptions of cutaneous and organic sensation, and J. M. Gleason (G) and M. Kincaid (K), graduate students in psychology. B and K had had previous experience in the analysis of heat, and worked in these experiments with knowledge: G, on the other hand, although an observer of experience, had only a short preliminary practice in the analysis of heat, and worked without knowledge. We shall discuss the two experiments separately.

Series 1. *Punctiform Stimulation.* We employed, in this series, the Zimmermann thermaesthesiometer, with cold water running through the one point, and warm through the other. The temperature of the warm water was always 44° or 45°C;[5] that of the cold, while constant for a single period, ranged from 8.25° to 13.5°. The flow of water (from large pails) was rapid, and the fall in temperature was never as much as one degree. The temperature of the room during the periods of experimentation ranged between 16° and 21°C. We worked on the forearm. The absolute position of the cold and warm spots was noted in mm. from the carpal folds, and their relative position in terms of the angle of the line which connected them. Directions were indicated as peripheral (P) or towards the wrist, central (C), right (R), left (L). The area of the cutaneous surface was included between cross- lines 2 and 40 mm. from the carpal folds, and the distance between the spots varied from 2 to 9.3 mm. The period of stimulation (measured by a soundless metronome) was for the most part five sec-

[3] F. Kiesow, *Zeit. f. Psychol. u. Physiol. d. Sinnesorg.*, 26, 1901, 237 (italics ours).

[4] *Op. cit.*, 237 f.

[5] We found it necessary to employ these high temperatures in order to secure a definite warmth-response from the warm spots. Our check against both pain and paradoxical cold was introspective and positive. In the preliminaries no observer ever reported either pain or cold when a warm spot alone was stimulated with a temperature of 45°. With dual stimulation of both warm and cold spots, neither pain nor cold was reported at the place where the warmth was localized.

onds. The instruction for B and (in the earlier series) for K read as follows: "After the signals 'ready,' 'now,' a stimulus will be placed on your skin for a short interval. When it has been removed, give as complete an introspective description of the sensory experience as you can. In the description you should enumerate as many sensory components as you can find, and characterise every component as fully as possible." For G and (in the later series) for K, the last phrase of the instruction read "*Describe or characterize every sensory component* as fully as possible."

Results of Punctiform Stimulation. The experience resulting from this method of stimulation is extraordinarily complex. Warmth, cold, pressure and heat may appear in succession, or two (sometimes three) of them may exist side by side. One component may change in intensity and fade out, and another familiar quality may take its place; a component may suddenly disappear, giving way to a new complex which all but baffles description. No two patterns are ever exactly alike, and the same two spots rarely give the same spatial and temporal patterns at different times even when stimulated with the same intensities. The task set our observers was therefore difficult, and it was made no easier by the general nature of the instruction. For the term "heat" could not be employed without prejudice, and the analysability of every complex was of course assumed. Despite these difficulties, however, all three observers reported the presence of heat or its equivalent. They have furnished us with a provisional description of its nature, and with a general picture of the spatial and temporal patterns for the total period of stimulation. We shall reverse this order in our discussion, and we begin with a few typical introspections:

B. "The heat was set in a fringe of warmth." "First cold, then a flash of warmth, then heat for a long long time; . . . most of the time no warmth or cold with it, but often a faint tinge of warmth, a sort of a halo very weak and thin that came and went. Two or three times . . . a tinge of cool, not a fringe but a little vague blotch, very faint, at one side." "A moderate cold, then strong heat, with a little warmth on one side of the heat and a little cold on the other."

G. "First a stinging heat, a small line of it. Almost immediately a sticky cold came around it, then the entire area got cold. Following this, a flash of heat came back in one spot of the cold area; this then disappeared and a diffuse warmth came round the cold patch." "First a line of intense warmth running on the PC direction; almost immediately, at the end of the line, a little area of cold. Very light contact along the warmth line, and heavier contact at the cold; the former was quite diffuse and irregular, a feathery thing, whereas the latter was compact, round and even. The warmth then spread out over the cold."

K. "Immediately following the initial pressure, quite an intense warmth with a slight pain element, a sharply localised, bright, penetrating, denting sting. This faded out rather abruptly, becoming a more diffused localized warmth, with an adjacent spot of cold." "First pressure at a single point, then warmth at the same point. The latter was very thickly concentrated; it seemed heavy and blunt, not spreading out with faint boundaries as usual. There was perhaps also a tiny pin-point of sting; of this I am not sure. At quite a distance there seemed to be hovering a faint cold; this did not seem to be on the skin but above it."

B reported the temporal order of the components in 24 of the 25 experiments in which he observed. Cold was reported first 21 times, heat twice, and pressure once. The second experience reported was heat 16 times, warmth 7, and cold 2. The third was cold 9 times, heat 4, pressure 2, and warmth once. Cold was at once followed by heat in 65%, by warmth and then heat in 17% of the cases. In two cases cold was followed by warmth and no heat appeared. Heat was most frequently followed by cold (11 times); in 7 cases, however, heat was present when the stimulus was removed.

G observed in 16 experiments, and heat was reported in 9. She was not so certain of the temporal order as was B; frequently two qualities were reported as appearing simultaneously. But, without doubt, the first experience was cold 11 times, heat 3, and warmth 2; the second was warmth 7, heat 4, and cold 2; the third was warmth 4, heat 3 and cold 1. Cold was followed at once by heat in 3 and by warmth and then heat in 3 of the 9 cases. Six times heat was followed by cold; twice by warmth.

K took part in 29 experiments. She was disposed to report the spatial rather than the temporal pattern. It is clear, however, from her introspections that in about half the cases the first impression was a cold pressure, and in the other half warmth either alone or accompanied by "sting." The second experience was most frequently sting either alone or accompanied by warmth; the third was usually cold, although warmth-*plus*-sting was often present without cold at the close of the experiment.

It will be seen that for all observers cold (aside from pressure) is generally the first quality to appear. This has also been observed by Alrutz, and accords with the fact that the reaction time of cold is shorter than that of warmth.[6] Another tendency too general to be meaningless is the continuation of cold after heat has disappeared. This was also found with areal stimulation by Alrutz, who supposes that the warmth adapts more quickly than the cold.[7]

The Nature of Heat. B reported heat in 23 of 25 observations, G in 9 of 16, and K reported what we believe to be its equivalent in 18 (possibly 19) of 29. Since we shall have more to say about heat after we have considered the second series of experiments, we shall here merely indicate the nature of the experience as thus far reported.

B began the series by referring to heat as an unique but not necessarily simple experience, the main characteristic of which was a quality something like pressure and something like pain. In the 5th experiment he calls this quality "sting," and describes it further as flat like pressure, bright like pain, and as having the promise but lacking the thrust of pain. Later he employs the term "smack" instead of sting, and describes this as smoother, and thus more like pressure, than pain. These two terms serve for the description of heat throughout the remainder of the series. Some heats are like smack, others like strong sting, some lie between pressure and smack, still others between smack and sting. B came to think of heat, therefore, as a simple quality lying in a series consisting of pressure, smack, sting, and pain; and this is analogous to a color-series like green, greenblue, bluegreen, and blue. In true heat no warmth or cold is discoverable; "psychologi-

[6] *Mind, loc. cit.*, 142; A. Goldscheider, *Ges Abhandl.*, 1, 1898, 299; Thunberg, *Skand. Arch. f. Physiol.*, 11, 1901, 414 f.

[7] *Mind, loc. cit.*, 143.

cally," he says, "it is laughable to think of heat as conditioned upon warm and cold." There are, however, some warm-heats, and he found at least one cold-heat; in these instances heat could be separated by analysis from the warmth or cold and examined alone.

Neither of the other two observers came to the experiment with more than a casual experience with other cutaneous qualities; and although both hit upon the term "sting" for the characterization of heat, and although both reported stings without warmth or cold, neither was able to distinguish clearly between sting and pain. K, indeed, seems at times to have made no distinction between the two experiences, "Cold," she reports, "was followed by pain (*i. e.*, sting; penetrating, concentrated but not very intense)." On other occasions she characterised the experience as "a sharply localised, bright, denting sting;" "a sting, very penetrating, sharp, conical;" "a large, heavy, diffuse pain (sting);" "a sting faint, delicate, slightly denting." G, on the other hand, was content with the description of heat as sting, and did not attempt to relate it to pain. On one occasion, however, she speaks of a "stingy pain," on another of "burning heat," and on two others of "burning pain."

Series 2. Grill Experiments. In this series we employed an areal stimulus, which consisted of a surface made of 8 glass capillary tubes, with warm water running through the even and cold through the odd numbered tubes. These tubes had an outside diameter of 6.5 or 7 mm., and a length of 18 cm. They were laid parallel, and as nearly apposed as the slight imperfections in the surface of the glass would allow, and in this position were fastened by wooden cleats to the board which served as arm-rest. The area between the cleats, 9.5 x 5.6 cm., was the surface employed as stimulus. The ends of the glass tubes were connected by rubber tubing, in the one case with the waste-pipe, in the other with T gas-pipes which in turn were connected with stop-cocks controlling the two streams of water. The warm water was furnished from a galvanized-iron tub holding about 15 gals.; the temperature, constant for an experiment, varied throughout the series from 43° to 45°C. The cold water came directly from the tap of the water supply, and ranged in temperature from 5° to 9°C. The procedure was as follows: *O* laid his forearm (occasionally his hand) on the grill, and the warm water was turned on and allowed to run until warmth was reported. Then the signal "now" was given, and the cold water was also turned on. The instructions were: "The experimenter will adjust the apparatus until you feel only warmth (and pressure) from the grill. At the signal "now" close your eyes and note the course of the sensation that ensues upon the warmth. If it is of any assistance to you, keep up a running verbal account aloud while the changes are in progress. After the trial you will be asked to describe the complete experience. Enumerate the sensory components and characterise them whenever possible, especially with regard to quality." All observers accepted the suggestion of the instruction, and gave running verbal accounts of the experience during its course. For this reason the time of application of the stimulus was indefinite, depending upon the nature of the report.

We had no intention of carrying out a carefully controlled series of experiments with this method. We hoped (1) to find an easy means of demonstrating the fact that heat may be derived from a simultaneous stimulation by warm and cold. We desired (2) to control for purposes of observation the course of the psychological experience (we could begin or end the period of stimulation with either warm or

cold, or both, or neither). And we were interested (3) in comparing the qualitative results thus obtained with those found by punctiform stimulation.

Results of the Grill Experiments. We found that this method is excellent for demonstration. The apparatus is simple in construction, and even the untrained observer can easily convince himself that heat derives from warm and cold stimulation. Moreover, the temporal course of the experience was under control; it could be made to begin with warmth, instead of with cold as in the punctiform series; and when cold ensued after heat, it is possible to reverse the order of change by turning off the cold and allowing the warm water to continue running. B did not generally report the temporal patterns; but G found that heat without cold always followed the initial warmth, except when the temperature of the cold water was as low as 5°, in which case heat came with cold. In 6 of 11 cases the initial warmth was reported to increase in intensity before heat came in, and in one instance "pain" appeared before the signal "now," *i. e.*, before the cold stimulus was applied. K also reported "sting" as the second experience in the majority of cases, and cold-*plus*-sting twice. She also found warmth present with sting twice before the signal "now." This latter experience is to be expected, since the temperature of the warm water was adequate to paradoxical cold.

All observers report heat (sting, stingy-pain) without temperature; heat with cold or warmth present but spatially different; warm-heats, and cold-heats. B substantiates his results obtained by punctiform stimulation, and concludes that "true heat" is a simple pressure-pain quality, with no trace of warmth or cold in it, and that warm-heat and cold-heat are fusions. He thinks that normal heat, the typical heat of every-day life, is a warm-heat or heat with warmth fringes or halos; and that cold-heat definitely carries the meaning of heat, and yet has cold in it instead of the typical component of warmth. Finally, he is less sure of the applicability of the terms "smack" and "sting" to the description of heat. He says: "they seem a little more complex than when I first used them;" and again, "I tried hard to get a better description of heat but without success. "Smack" is good, but it doesn't seem persistent enough; 'tear' is all right, but it doesn't seem penetrating enough; 'drawing' is all right, but it sounds as if it might be just pressure." "It's a true pressure-pain, I am sure, and it is not at all a true pressure or a true pain. It is between pressure and the painful part of ache. A drawing, tearing quality is the best I can do for heat verbally." K continues to employ the term "sting," apparently with the meaning of pain; and G, in this series, always uses the terms "stingy pain" or "burning pain," and characterises the latter as a stingy pain with warmth in it.

Conclusion. We agree with Alrutz that heat, a cutaneous quality that is neither warmth nor cold, may result from the simultaneous stimulation of warm and cold spots. We do not agree with Thunberg that heat is a *Mischempfindung;* we find, rather that heat itself mixes and fuses with warmth or cold; that there may be spatial mixtures, and probably fusions of warm and heat or of cold and heat at the same place. But our observers are not agreed as regards the presence of the quality of pain in the experience of heat: our most experienced observer, B, believes with Alrutz that heat may occur without pain; whereas our other observers employ the terms sting and stingy pain

to characterise the experience.[8] These two observers, therefore, would support the contention of Kiesow. We are inclined, however, to accept the view that true heat is not true pain. For (1) neither of our two observers who report the experience as "sting," meaning thereby pain, has had more than a casual acquaintance with the qualities of pain. These observers were not, therefore, adequately prepared to distinguish between true pain and heat. (2) The meaning of heat in everyday life is undoubtedly associated with pain; so that even if heat may exist without pain, it nevertheless points towards pain. (3) This fact, taken together with B's characterization of psychological heat as a quality lying between pressure and pain, makes intelligible Thunberg's "sensation of a burning sensation about to arise," B's expression "heat with a promise of pain," and Kiesow's *schmerzbetonte Empfindung*. We do not, however, regard the matter as settled. Kiesow's contention that heat can be obtained only with stimuli near, at, or above the pain limen, can be fully met only by reproducing the experiences reported in this paper with stimuli that are beyond the shadow of a doubt inadequate to pain; *i. e.*, with a warm stimulus that is inadequate to paradoxical cold, and with a cold stimulus that proves experimentally to be inadequate to ache in the region of the cutaneous surface chosen for experimentation. The next logical step along the lines of this investigation is accordingly the correlation of heat and its fusions with various combinations of temperatures of warm and cold stimuli.

[8] It may be said that B was disposed *a priori* to find heat "a pain" or "pain." His descriptive report was, therefore, contrary to the lines of autosuggestion.

THE MENTAL DUET

By Arthur S. Phelps

Are there a masculine and a feminine mind? Do men and women differ by nature? If their eyes catch the same picture, do their brains offer the same impression to the mind? Modern psychology tells us that the influence of the brain over the mind is enormous. The materialist declares that this influence is determinative,—indeed, that thought is only as a mist rising on the surface of the cerebellum. While sane philosophy generally rejects this view, it still recognizes that bodily conditions, and particularly the cells in the brain, exert a powerful influence upon ratiocination, that they produce habits of thought. And through thought, action. And through action, destiny.

Animal life began most simply. The amoeba, at maturity, parted in twain. His children were all twins. His type increased by arithmetical progression. Biology tells us that sex was first determined by nourishment. The best nourished individuals became females, the more meagre, males. This achievement of the Creator's evolutionary process required millenniums of natural selection. The "Little Carpenter," as Huxley charmingly pictures the unseen life-force, works very slowly. But none the less surely, and progressively.

And thus there grew up what we may call the distributive and the secretive temperaments. Nourishment still dominates. These temperaments are the masculine and the feminine genius, respectively. Science names them katabolism and anabolism. They are the spending and hoarding faculties in nature's economy. The masculine element is a constant tearing down and wasting away. The feminine element is receptive, edificative. Anthropology has written the history of these bipolar, reciprocative forces. Competition declares it to be a duel. Antagonism. Co-operation proves it to be a duet. The novel has popularized this story of the katabolic and anabolic temperaments in man and woman. Man lays himself at woman's feet; she accepts him. Some one has said that the story of every novel is, "She was beautiful and he fell in love." How little the hero and heroine know that the eternal sweep of agelong destiny has conveyed heart to heart across meeting lips! The very stars fight for them—particularly the moon.

What term has psychology to mark the difference in mental processes betwixt the man and the woman. Katabolism it calls reason; anabolism it calls intuition. Reason is the sacrificial, the fighting temper of the mind. Intuition is the receptive temper. The one hunts truth; the other entertains it. The instrument of the former is logic. The instrument of the latter is feeling. Logic contains two elements, inductive and deductive. Intuition contains two elements, instinct and imagination.

This mental distinction had its origin in natural causes. The male was stronger physically than the female, and could force his ideas and her submission. Finding physical superiority denied her, woman, through generations of submission, has gradually built up a matchless weapon of defence. It is her intuition. The processes of reason

are slower. Man has had time, given him by his physical superiority, to develop his conclusions by inductive and deductive reasoning. Against the invincible arm of the male animal, rose the quick wit of the female animal. It was her only defence.

Who shall say to-day which mental method is superior, the man's or the woman's? Is reason a higher faculty than intuition? Is intuition more sure than reason? Man suspects the conclusions of woman's intuition, because they are so rapid. She suspects the conclusions of man's reasoning, because it is so slow. If either be higher than the other, then one sex is more advanced in the evolutionary process than its companion. They are twin elements. They are parallel streams from the same spring. Each is found in its measure in the well balanced mind. But the predominating faculty of man is reason. Of woman it is intuition. That is why they cannot take each other's place in the world. That is why a normal woman cannot serve on a jury. That is why a man cannot say the last word on moral issues. For the one, reason is demanded; for the other, intuition. The two temperaments are mutually reciprocal. There is a large sphere of truth—perhaps half of it—open to reason. There are great continents of truth, the large domain of metaphysics, that reason cannot explore without the lantern of intuition.

While we think of the masculine and feminine minds as diverse, one doing its work with the tool of reason, the other with the tool of feeling, yet they are one in their origin; one in their conclusions, though differing in their methods. Man and woman, hand in hand, with wandering steps and slow, like children in the night in a great and trackless forest, set their faces toward the golden gates of the Temple of Truth, their faces lighted by hope, their steps made strong by mutual encouragement, their hearts guided by the divine wisdom of the unseen Father.

BOOK REVIEWS

Le Génie féminin français. By MARTHE BORELLY. Paris, Boccard, 300 p.

In her well-written book, Marthe Borelly examines what are the limits of woman's personality and what her true place in society is, what it was in the past, what it must and will be after the war. The book contains also an interesting study of love, and the relation existing between love and fashion.

The author does not admit the principle of the equality of the sexes. "Nature," she says, "has made man and woman complementary." It established a law of necessity and not of equality. Marthe Borelly has no sympathy for the suffragists. She seeks to direct the future of her sex along the path marked out by the highest feminine culture of the past.

For many people, the ideas of the author will perhaps appear to be old fashioned, but she expresses the views of the majority of French womanhood. While not a scientific treatise, the book is very well written and is completely free from hysteria, which is so common in discussions of the woman question.

M. P.

Le Sens de la mort. By PAUL BOURGET. Paris. Plon, 1916. 328 p.

One of the books most read in France since 1916 and also one of the most commented on is this stirring meditation, *Le Sens de la mort,* upon a topic that the immense and frightful war brings constantly to our thoughts.

The author of "Le Disciple" and "Les Essais de Psychologie Contemporaine" shows us on one side a superior man, a great physician. He is atheistic, he denies the spiritual forces and believes only in the positive ones. Death stands suddenly before him. He cannot adapt himself to it. "He accepts it with courage, but it is a courage formed of crushed resignation. It is his intellect bowing, with a desperate impotence, under the action of irresistible and supreme forces, for him monstrous, because they created him only to crush him." On the other side, Bourget shows a young French officer, with a culture not far removed from the physician's culture, but the young man believes in God, in a future life, in a salvation "which is to keep living the best of ourselves." He is wounded, he knows death is coming, his doctrine allows him and gives him the strength to accept it, he adapts himself to it. Then where the other sinks, he triumphs. For the former one death is "an absurd catastrophe," for the latter it is a "consummation, an accomplishment." And Bourget affirms that "Death has no meaning if it is but an end, it has one, if it is a sacrifice.

Le Sens de la mort not only brings forth a very interesting problem of religious psychology but it can be interpreted as a sign of the new spirit which is being born in France.

M. P.

Mors et Vita. By ALFRED LOISY. Paris, Nourry, 1916. 86 p.

Mr. Loisy, the author of this little book, is a former catholic priest who, following the example of Renan, broke with the church because he could no longer blindly believe in the Roman Catholic dogmas.

Mors et Vita is a criticism of the two famous works: *Le Sens de la Mort,* by Paul Bourget, and *Le Voyage du Centurion,* by Ernest Psichari, works that are representative of the so-called "*Mouvement Catholique Moderniste,*" now taking place in France and which includes numerous French authors like Bourget, Barrès, Bazin, a movement which is so brilliantly illustrated by the "ultimate sacrifice" of young French intellectuals, among them Péguy and Psichari, the latter a grandson of the great apostate Renan, both of these young men converted to the Roman Catholic Church and killed on the Field of Honor.

The criticism of Loisy is extremely keen. The author transports into the apologetical field what through the writings of Psichari and Bourget thousands of young Frenchmen feel intuitively and instinctively.

Loisy tries to demonstrate that nothing very strong binds the renewal of the French spirit to the Catholic dogmas. He declares, however, that a great number of young men, not less ignorant of doctrinal and theological Catholicism than Ernest Psichari, adhere to the church as a result of the horror they feel for the moral emptiness of our non-religious society before the war. Renan, he says, had above all experienced the church intellectually; Ernest Psichari and men like him have experienced the century as "impressionists" and through the feelings and realizing its inadequacy, he turned to the church." "The question," continues Loisy, "would be to know if the traditional center of our moral life would not tend to displace itself, and if a "nation of souls" may not be in the making, not against the old religious confessions, but outside of them and especially of the Catholic church." M. P.

Gaspard, By RENÉ BENJAMIN. Paris, Fayard, 1915.

Among the numerous vivid books that have been written by soldiers from their own experiences during the war, *Gaspard* may be counted as one of the best.

Gaspard is a product of Paris. He joined his regiment in the beginning of the war, and among hardships and misfortunes, while engaged in battles, his spirit always joyful, his clever, lively, ingenuous repartées, so characteristic of the Parisian, keep the spirit of his comrades always high. He is intelligent and equal to any emergency, he derives advantage from anything and makes the best of bad situations. He is patriotic and understands why he is fighting. He is the real type of the French soldier.

The reading of Mr. Benjamin's book would be very useful for those who are interested in psychology of soldiers. M. P.

L'Avenir de l'Intelligence. By CHARLES MAURRAS. 2nd ed. Paris, *Nouvelle Libr. Nationale,* 1917.

According to Maurras, intelligence, which is a predominant function of the brain and which expresses itself by writing is likely to lose its rôle and dignity. It is in danger of falling more and more under material influences; gold will master it, enslave it and domesticate it. One of the causes of this situation is that Romanticism is developing in the direction of the most unrestrained and narrow individualism. Maurras suggests some political remedies, among them the rule established by the genius of Auguste Comte. This gives Maurras an op-

portunity to make a very interesting study of the founder of positivism and of his philosophy. M. P.

Les Diverses Familles Spirituelles de la France. Paris. EMILE PAUL, 1917. 312 p.

The new book of Mr. Barrès, the eminent academician and President of the French Ligue des Patriotes, contains a series of articles which were published last year in the French newspaper l'Echo de Paris. It describes the different spiritual groups which go to make up the French people—the Catholics, the Protestants, the Jews, the Socialists, the Traditionalists. He portrays the changes that have taken place among them under the influence of the war. It is a eulogy of the Union Sacrée, that arose in August, 1914, out of the deep patriotism of the French people, after the battle of the Marne, the Union Sacrée was very near being wrecked by the too great confidence and optimism that prevailed in France. It has renewed its strength in the last three years, the present union is stronger, deeper, firmer, of a better quality than the first one. "It consists not," says Barrès, "in disavowing our beliefs, or in relegating them to a limbo, like a useless article. It consists of everything that strengthens our confidence, it consists of those deeply rooted beliefs that bind men to the eternal verities. Each of the spiritual groups has maintained its own rights and ideals but in their purest form and as a result of this has not interfered with the full cooperation of all the groups."

Mr. Barrès has built up his theme on the best materials, with written testimonies of fighters, letters of soldiers, many of which he reproduces. He has collected them from all parts of France.

The book is perhaps the most stirring and valuable work on the new spirit of France, that has been published since the beginning of the war. M. P.

L'ILLUSTRATION. Paris. An illustrated weekly.

L'Illustration is a French illustrated weekly. All its pages are devoted since the beginning of the war to war articles. Every number brings an editorial by Mr. Henry Lavedan, the well known French academician, on a topic of immediate interest. For instance, in the numbers of June he describes the effects upon the people of Paris of the big gun bombardment. After this follow studies on the military, political, moral situation of France and her allies.

All the articles are illustrated by well known French artists and the mechanical work of reproduction cannot be surpassed.

A complete file of this valuable paper covering the period of the war will be a veritable mine for the psychologist and it is to be hoped it will find its way eventually into all psychological laboratories devoted to research. M. P.

Ma Piece and *Le Tube* 1233. By PAUL LINTIER. Paris, Plon, 1916-1917. 300 p.

Among the numerous French and foreign books published since the beginning of the war, describing the life of the soldiers at the front, there are two, written by a soldier himself, at the front, sometimes between bombardments, at other times inside a dug-out, by the light of a candle, which are really masterpieces, not only for the literary point of view but also for the scientific point, because they are the real expression of truth. They are an important contribution to the psychological study of the soldier in time of war.

They are reports of battles, taken from day to day, from the mobilization up to the time of the glorious death of the author. One lives with him the feverish days of the beginning of the war—one starts for the front, amidst the cheers of the populace, one arrives at the firing line and one feels the emotion of being for the first time under fire. One revolts sometimes in having to retreat, when the position seems to be assured, and one realizes only afterwards that in formidable battles, one is only a small part of a great all. One lives the battle of the Marne, the victory and afterwards the tenacious and patient war of position, one cooperates in bringing a gun into position—one takes part in the construction of the casemates; one understands the attachment of the soldiers to their officers.

In the "*Le Tube* 1233" (which is the number of the gun) the author continues his observations and descriptions. One meets again the old battery, this time in Alsace, near the Hartmansweilerkopf, in the winter. One lives the sometimes monotonous life of the "poilu" in this sector and one agrees with Lintier when he says: "One of the surest characteristics of the present struggle is its tedious uniformity, danger, the death present nearly always in the same manner. One shell seems no more than another shell. And when the risk becomes less immediate, or when the threat of death diminishes, how poor then is our existence and how devoid of contingencies! The abrupt return of danger, the contact even with death is no more unexpected. Indeed, weariness will not have been one of the smallest hardships that the soldiers of this war suffer from.

"To be sincere, the diary of a fighter must express much monotony."

The morning of his death, Paul Lintier wrote still: "The barber of the battery arrived near midday, on his bicycle, with his shears and razors. At the front of the dug-out of the first gun, where the observation balloons cannot detect us, there is a table and a seat in the sun. Seated in a circle, on the ground, one talks while the barber is busy shaving and cutting hair. A German battery shoots. Reprisals upon Fossieux. Twenty-five shells per gun . . . " And the publisher of the book adds:

"Here end the unfinished pages of "Le Tube 1233." In the afternoon of the 15th of March, 1916, Paul Lintier fell under a German grenade. His latest war notes, picked up on his bleeding body, have been put together by the care of his friends and war comrades.

It is interesting to compare the two books of Paul Lintier with the much known "Le Feu," (Under Fire) of Barbusse. *Under Fire* shows us the war only on its most horrible side, its most depressing. There are regrettable omissions in that book and inexcusable exaggerations in these times when we need all the possible comfort to face the hard necessities of the great struggle. The soldier of Barbusse is a real slave. The splendid conduct and the superior spirit of the fighters are with the books of Sergeant Major Paul Lintier the best reply to such writings as those of Barbusse.

There remains from reading "Ma Pièce, and "Le Tube 1233," a great admiration for the "poilus" and a confident optimisim in the valor, sacrifice and patriotism of our soldiers.

Those who wish to study the psychology of the soldiers would make a great mistake in confining themselves to such works as "Le Feu," which have obtained an unmerited success; they could not do better than to read the works of writers like P. Lintier, Ern. Psichari, Ch. Péguy and others who have fought and died in early manhood, leaving behind them faithful records of the life of the soldier in this great and glorious conflict.

M. P.

BOOK NOTES

Human nature and its remaking. By WILLIAM ERNEST HOCKING. New Haven, Yale University Press, 1918. 434 p.

The author says his work is that of the quarryman with his blasting powder, rather than that of the sculptor with his chisel. We are only now beginning to learn the technique of dealing with the old problem of human nature, and with larger masses. Part I is devoted to orientation, an art peculiar to man, the emergence of problems, the possibility of changing human nature, what changes are desirable, liberation versus discipline. Part II is the natural man, the elements of human nature, the range of reason, survey of the human equipment, central instincts, the will, and the writer even dares to append a note on Freud. Part III is conscience, the interest in justice, its relations to general will and instinct, current fallacies regarding sin, which is blindness and untruth, why men sin, sin as a status. Part IV is experience, the agencies of remaking tasks and methods of experience, the dialectics of pugnacity. Part V is society, social modelling, main distinctions of social modelling, ideals and their recommenders, laws and the state, institutions and change, education, the right of punishment. Part VI, art and religion, the voice of God, public and private order, society and beyond society, the world of rebirth, the sacred law, art and human nature, religion *per se*. Part VII is Christianity, what it requires, its relations to pugnacity, sex love, ambition, its crux, the theory of participation, the divine aggression, the last fact.

This book makes a peculiar impression upon the thoughtful reader. The author has grasped the great idea that is coming home to cultivated men in so many fields of life now, that the chief study of mankind is man, and that we must not lose ourselves in specializations that obscure the larger meanings of life or destroy perspective and make larger orientation impossible. On the other hand, the enormous field the writer attempts to cover in these pages is simply appalling and shows that the author's attitude is essentially pedagogic, even more than it is philosophical. Perhaps this kind of work is necessary for students, but to our thinking it is hardly scientific, in the new, higher sense that is supervening in this field; nor does it entirely escape the danger of leaving the student with a somewhat paralyzing sense of finality which must interfere with his further growth. There is some similarity between works like this and the tremendously comprehensive systems of philosophy, and perhaps ethics, that a couple of generations ago made the staple of academic teaching.

The new rationalism; the development of a constructive realism upon the basis of modern logic and science, and through the criticism of opposed philosophical systems. By EDWARD GLEASON SPAULDING. New York, Henry Holt & Co., 1918. 532 p.

While there are many ways of studying philosophy, the point of view and method here has been of too infrequent use. The author notes that at present there is far deeper interest in systematic than in the historical treatment of philosophy, although the latter method should always be present, if always subordinate. The result of a mainly historical method is that the student is perplexed by the multiplicity of systems which are disclosed. What he really ought to know

is what those postulates from which each philosophical system is logically derivable are, and also whether there is one body of principles common to all systems and logically pre-supposed by them. This latter is the author's view and he attempts to give such principles. Accordingly, he treats, in successive sections, the problem of the point of view, historical problems, methods, the latter subject being very fully treated. In Part II we have the causation philosophies, phenomenalism, subjective idealism, positivism, materialism, pragmatism. Then the substance philosophies follow, viz., those of objective idealism. Then follows a discussion of realism and the function philosophies, involving the hypotheses and principles of realism, its form as constructive and detailed. This work is a contribution of real value.

The exceptional child. By MAXIMILIAN P. E. GROSZMANN. New York, Charles Scribner's Sons, (c. 1917). 764 p.

This author has for many years been an eminent and successful worker in the field which this book represents, and his conclusions will be welcome and profitable to all those who are interested in the subject. He says his purpose is to give a perspective of the entire situation, and to suggest ways and means of coping with the problem in its various aspects. In Part I he treats the problem of the individual child, discussing education in general, then inefficiency, different civilization levels in modern society, classification and terminology, the normal and potentially normal child, the exceptionally bright child, psychopathic disorders and constitution, feeble-minded groups, treatment of delinquency, sex perversion and prostitution. Part II is devoted to the problem of clinical research and diagnosis, and he discusses here the differentiation of exceptional development of children, standardization, the Binet scale, the meaning of an educational clinic, schedule of tests. Part III concerns the problem of prevention, adjustment, organization; and here he treats the legal provisions, eugenic considerations, including marriage and heredity, home life and training, school problems, kindergarten period, general provisions for variations trom type, provisions for exceptional children, sanataria, and atypical children, and the training of teachers. In an appendix he treats of the city and her boys and gives us a medical symposium by many different writers.

Universal training for citizenship and public service. By WILLIAM H. ALLEN. New York, Macmillan Co., 1917. 281 p.

"Until-after-the-war" is a new word and a qualification for all our thinking and planning. All kinds of ideals will be realized after the war, and so the author discusses the new patriotism, its menace if unrestrained, the cost of unpreparedness, universal training for citizenship is possible, the essential minima, training for volunteer civic work, for drill-masters and teachers, for lectureships, for entrance into the civil service, for the professions, for a continuance in public and quasi-public service, specialized training in parenthood, the especially gifted. The future of American democracy is magnificent but it has its price and conditions as well as rewards. Each must prove his title clear to American citizenship by learning, liking and living the arts of public service.

Religious education and American democracy. By WALTER SCOTT ATHEARN. Boston, Pilgrim Press, (c. 1917). 394 p.

The present war will have been waged in vain if it hands democracy over to an ignorant and godless people. Intelligence and godliness

must become the common possession of the whole human race. Hence the author attempts to develop a constructive program of religious education for the American people, also to analyze existing organizations and agencies, to determine our present educational assets and liabilities; and third, to survey the available literature on the various problems involved in a nation-wide program of religious education. Interesting chapters are on the correlation of church and public schools; community system of religious education; the unification of educational agencies; the college and religious education; the graduate school.

An elementary handbook of logic. By JOHN J. TOOHEY. New York, Schwartz, Kirwin and Fauss (c 1918. 241 p.

This work being elementary, omits the subtler questions that frequently find an extended place in treatises on logic. It is not designed for private study but for the classroom and leaves detailed explanation of the various topics to the teacher. It has two distinctive features, (1), distinguishing between the act of inference and the process of inference, each being given a special chapter; and (2), the hypothesis of the distribution of the predicate has been abandoned.

Studies in the history of ideas. Edited by the Department of Philosophy of Columbia University. Vol. I. New York, Columbia University Press, 1918. 272 p.

This is volume one of the collection of studies in the history of philosophy, the present volume containing thirteen different papers, by as many different writers, e. g., M T. McClure, Appearance and Reality in Greek Philosophy; W. T. Bush, An Impression of Greek Political Philosophy; John Dewey, Motivation of Hobbes' Political Philosophy; H. G. Lord, The Attempt of Hobbes to Base Ethics on Psychology; and F. J. E. Woodbridge, Berkeley's Realism.

Proceedings of the American Society for Psychical Research. Vol. XII, June, 1918. New York, American Soc. for Psychical Research, 1918. 735 p.

This volume is entirely devoted to the Smeade case by James H. Hyslop, Ph. D. The first part is a general summary, ending at page 175, while the rest of the work consists of appendices.

What men live by, and other tales. By LEO TOLSTOI. Translated by L. and A. Maude. Boston, Stratford Co., 1918. 66 p.

AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY

Dr. Ales Hrdlicka, with a distinguished list of associate editors, has founded and issued two numbers of a new journal, the American Journal of Physical Anthropology. It was a bold enterprise to inaugurate such a journal in these war times, when all editors of scientific periodicals are finding their subscription lists reduced and prices of publication increased. There was, however, not only ample room but real need for such a journal, and not only psychologists, physicians and educators, but all students of and workers on the raw material of human nature will welcome this journal, especially if it can maintain itself on the high level which the first two numbers take, as its board of editors leave no doubt will be the case.

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